# AFF—Biotech—Updates

### 1AC – Innovation that Excites

#### Current uncertainty in US-NATO biotech industry has the potential to collapse the industry and deck innovation

Jonathan Smith 22, 1-3-2022, "European Biotech Industry Braces as War Erupts in Ukraine," Jonathan Smith studied Neuroscience in the University of Bristol, trained mice in Eisai, Hertfordshire, for one year, received his Ph.D. at the University of Leicester,Labiotech.eu, <https://www.labiotech.eu/trends-news/ukraine-war-europe-biotech//> AL

Europe has been blindsided by its biggest war in decades with Russia’s invasion of Ukraine. Amid a raging humanitarian crisis, the biotech industry is preparing for increasing economic uncertainty, cyber threats, and clinical trial disruptions. The invasion of Ukraine by Russian forces last week caused a widespread outcry from the European community. The geopolitical landscape has undergone a historic shift and the tragic consequences of the event are rippling out to the European biotech industry. “The conflict in Ukraine is above all an enormous and deplorable shock to all of us,” said Miguel Forte, CEO of the Belgian regenerative medicine specialist Bone Therapeutics. “Our thoughts should go for those people, both in Ukraine and Russia, directly affected by reckless and irresponsible leadership.” The crisis has many facets and the biotech industry in Europe is preparing itself for challenges on a number of fronts. The human crisis The human cost of the invasion is expected to be heavy, with deaths and injuries from the conflict currently numbering in the hundreds, and a growing number of refugees moving west. The supply of lifesaving medications to and from the region are already being disrupted; the World Health Organization recently reported an urgent shortage of oxygen for use in healthcare in Ukraine. Another factor at play is the clamping down on air travel and shipments to and from Russian companies. “The primary and immediate consequences will be affecting Ukraine, but the impact could also likely be felt in Russia and for the Russian population,” said Forte. He added that other countries could be hit indirectly by the chaos. For life science companies, the impact will be strong in countries close to the epicenter of the conflict, including the Baltic states and Eastern European nations. These countries are facing uncertainty from the neighboring crisis, and many resident companies have employees and close contacts in Ukraine. In the Lithuanian life sciences industry, there are “companies that have business units, collaborations, and clients in Ukraine, which now has stopped,” said Monika Paule, CEO of the Lithuanian gene editing specialist CasZyme. “Companies are willing to relocate their employees, move collaborations to other countries, but all hope to get back to operations in Ukraine when the conflict is over.” While countries close to the conflict face large challenges, Paule sees life science companies in these regions also playing a strong role in alleviating the situation. “The sector is ready to help Ukraine by all means during and after the conflict either with medical supplies or bringing business activities back to the country,” she said. Clinical trials caught in the middle European biotech companies now face delays to clinical trials that are being run in Ukraine and Russia. The two countries have increasingly contributed to international studies over the last 10 years thanks to easy access to patient populations; Forte told me there are currently about 500 ongoing studies in Ukraine and over three times more in Russia. The ability of the sponsors, contract research organizations, and suppliers to keep going during the invasion is limited. “We can expect centers in Ukraine to shut down immediately to protect its staff and patients,” said Antoine Papiernik, Managing Partner of the investment firm Sofinnova Partners. “For Russian centers, the integrity of data from those sites might be at stake, and trials that are reliant on those sites will likely be affected.” Overall, Forte advises that big pharma and biotech companies focus on maximizing the safety of clinical trial staff and participants in affected regions. To compensate for the trial shortfall, companies may ramp up recruitment efforts in countries away from the war zone. However, the shifts will likely mean that Ukrainian and Russian patients lose access to many experimental treatments. Even patients that are included in clinical trials in affected regions could have poorer monitoring from clinicians due to the challenging conditions. Financial consequences threaten biotech stocks In addition to the human tragedy caused by the events in Ukraine, financial aftershocks are expected. Many European nations have launched a volley of sanctions against Russia and its ally Belarus. These include bans on investments flowing to Russia-based banking and oil industries in addition to the removal of some Russian banks from SWIFT, the international financial transactions system. The current conflict and resulting sanctions on Russia could have direct and psychological repercussions on the overall business environment in Europe and scare off already risk-averse investors from the biotech scene. Forte sees less impact on early-stage private investment, but bad news for public biotech firms and life sciences companies at later stages of drug development. This blow comes as biotech stocks are already in an anemic situation due in part to inflation fears. “It was already tough in Europe since the beginning of the year, and it might worsen even more,” said Bertrand Delsuc, founder of the business intelligence firm Biotech Radar. “Cash is king, more than ever.” Nonetheless, Papiernik is confident that the biotech industry can pull through. “Biotech has, in the past, demonstrated resilience compared to many other industries,” said Papiernik. “Protecting human lives in the immediate term remains the priority, but I hope we can also preserve the infrastructure enabling us to develop drugs that will help patients in need over the long term.” Cyberthreats to life sciences grow Part of the modern military arsenal is cyberattacks, and cyber threats are growing as Europe and the US slap economic sanctions on Russia. “Several cybersecurity agencies and government bodies have warned about Russia’s ability to retaliate asymmetrically through cyber means,” said Charles Fracchia, CEO of the US firm BioBright. “This means that any sectors of the EU, NATO, and the US economy are likely to be targets, including critical sectors such as banking, healthcare, and life sciences. In life sciences, the threat is probably highest for critical operations such as vaccine manufacturing, biomanufacturing more broadly, and large clinical centers.” Life sciences companies have been caught in the crossfire in the past; the US big pharma MSD lost over €1B in 2017 when it was hit by malware known as ‘notPetya,’ designed by Russia to target Ukraine. It took until January 2022 for MSD to claw back damage payments from insurers. “The notPetya attack was ostensibly not targeted at [MSD], and yet, it had this enormous effect, thousands of miles away,” said Fracchia. “[MSD] was big enough to withstand this, but it is clear that our industry could not withstand a targeted attack, to say nothing of the smaller biotech’s ability to survive altogether.” To endure pressing threats from cyberattacks, biotech companies are advised to assess their security measures and keep them up to date. Europe’s biotech industry braces itself Despite the bleak conditions in Ukraine, there might be a silver lining in the long term. European countries are presenting an increasingly united front against Russia’s actions in Ukraine, which could strengthen links between Europe’s various life sciences hubs, and improve the supply chains of medicines to Ukraine. In addition, the EU is considering lowering its dependence on Russian fossil fuels by increasing investments in renewable energy. This move could benefit biotech companies that aim to usher in a circular bioeconomy. For now, there are numerous ways that biotech companies can weather the current geopolitical storm. Many biotech players have signed a pledge to halt business activities with Russian companies and investors. According to Paule, biotech companies can help the situation in Ukraine by focusing on how to use their contacts and resources to bring medical supplies to those in need, in addition to providing work to Ukrainians coming to the rest of Europe. And, as Forte added, biotech startups should be confident that their efforts will bear fruit in the difficult situation, “even if at this stage there seems to be little space for optimism.”

#### Biotech revolution has the potential to create a new wave of innovation to solve for a litany of existential threats BUT effective regulation is key

Michael Chui 20, 5-13-2020, "The Bio Revolution: Innovations transforming economies, societies, and our lives," McKinsey & Company, <https://www.mckinsey.com/industries/life-sciences/our-insights/the-bio-revolution-innovations-transforming-economies-societies-and-our-lives>//AL

A confluence of advances in biological science and accelerating development of computing, automation, and artificial intelligence is fueling a new wave of innovation. This Bio Revolution could have significant impact on economies and our lives, from health and agriculture to consumer goods, and energy and materials. Some innovations come with profound risks rooted in the self-sustaining, self-replicating, and interconnected nature of biology that argue for a serious and sustained debate about how this revolution should proceed. Accidents can have major consequences—and, especially if used unethically or maliciously, manipulating biology could become a Pandora’s box that, once opened, unleashes lasting damage to the health of humans, ecosystems, or both. The risks are particularly acute because many of the materials and tools are relatively cheap and accessible. Moreover, tackling these risks is complicated by a multiplicity of jurisdictional and cultural value systems, which makes collaboration and coordination across countries difficult. Sidebar COVID-19 and bio innovations However, new biological applications are already improving our response to global challenges including climate change and pandemics. Global responses to the novel coronavirus—SARS-CoV-2—illustrated substantial advances in biological science in just the past few years. The speed with which scientists sequenced the virus’s genome—weeks rather than months—bore witness to the new world of biology described in this research. However, sequencing is just the start: biological innovations are enabling the rapid introduction of clinical trials of vaccines, the search for effective therapies, and a deep investigation of both the origins and the transmission patterns of the virus. As much as 60 percent of the physical inputs to the global economy could, in principle, be produced biologically—about one-third of these inputs are biological materials (wood or animals bred for food) and the remaining two-thirds are nonbiological (plastics or fuels) but could potentially be produced or substituted using biology. Therefore, it is possible that bio innovations could impact up to 60 percent of physical inputs, although attaining that full potential is a long way off. Even modest progress toward it could transform economies, societies, and our lives, including what we eat and wear, the medicines we take, the fuels we use, and how we construct our physical world. In human health, at least 45 percent of the current global disease burden could be addressed using science that is conceivable today. A pipeline of about 400 use cases, almost all scientifically feasible today, is already visible. These applications alone could have direct economic impact of up to $4 trillion a year over the next ten to 20 years. More than half of this direct impact could be outside human health in domains such as agriculture and food, consumer products and services, and materials and energy production. Taking into account potential knock-on effects, new applications yet to emerge, and additional scientific breakthroughs, the full potential could be far larger.

#### We isolate 2 internal link’s to disease spread

#### 1-- Innovation can push back against the threat of mass disease spread through vaccine creation, disease detection systems, and biosecurity preparedness

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With a quarter of a million dead in the United States and more than a million globally, a massive economic toll,a and a second wave in full swing in the northern hemisphere, the United States and other countries are paying a price for years of neglecting biosecurity as a top-tier national security priority. For years, biosecurity has been the poor relation of the ‘other’ securities for one simple reason: policymakers and analysts failed to grasp just how devastating a highly transmissible new virus in a highly interconnected world could be, and viewed a devastating global pandemic or catastrophic bioterror attack as very unlikely. This article first describes how the COVID-19 pandemic has upended such assumptions, requiring policymakers to rethink both the potential impact and likelihood of the most concerning biological threats (bio threats). Based on this author’s decades of experience confronting CBRN threats,c it then makes a series of observations on the approach now needed to counter biological threats. Some have seen this crisis as a one-in-a-100-year event. But, as this article will outline, this is both naïve and risks creating complacency. Unless countries around the world develop a comprehensive biosecurity strategy and coordinate their efforts, pandemics (either natural or engineered) could devastate the planet every decade. The New Bio Threat Horizon The Need to Rethink Potential Impact Policymakers around the world did not grasp just how large the impact of a bio threat could be. Beyond the enormous human and economic impact, the current pandemic has exposed the weakness, lack of preparedness, and poor responsiveness of healthcare systems of even highly developed countries like the United States and the United Kingdom. And the virus has inflicted carnage, even though SARS-CoV-2 (the virus that causes COVID-19) is not especially virulent. The world may be confronted with other viruses in the future whose combination of virulence (the harm a pathogen does to its host), transmissibility, and other characteristics pose much greater danger. While overwhelming evidence points to SARS-CoV-2 spontaneously spreading to humans, the advances in synthetic biology and the growth in the number of Level 3 and 4 biocontainment facilities around the world storing deadly viruses1 mean there is also the very real possibility that in the future, bad actors will try to engineer or steal/obtain a highly transmissible and highly virulent virus and unleash it onto the world. Another risk is accidental releases from such biocontainment facilities. COVID-19, a highly transmissible but not very virulent pathogen, has had a devastating global impact, a fact that will not have gone unnoticed by rogue states and terror organizations. Advances in synthetic biology have created tools that could be put to malevolent use. In the last two decades, scientists synthesized the poliovirus from its genetic sequence,2 recreated the 1918 Spanish flu virus,3 and succeeded in modifying the H5N1 avian flu virus so that it resulted (in a research laboratory) in airborne transmission among mammals.4 In the future, we should think of weaponized biology as no less of an existential threat to the planet than weaponized atomic science. It should also be noted that the fear and panic that even a medium-scale bioterror attack could create could have dangerous implications that may rival or even surpass the immediate loss of life. The Need to Rethink Likelihood Given the fact that in late 2019 when, as far as is known, COVID-19 cases first started emerging in China, it had been more than a century since the previous catastrophic outbreak (the 1918-1919 “Spanish flu” pandemic),d it was unsurprising that many thought of such pandemics as a one-in-a-100-year event. Such assumptions should no longer hold. The encroachment of human settlements into areas that had previously been sanctuaries for wildlife5 and the popularity in some parts of the world of markets where people and wild animals are brought into proximity have made it more likely viruses will make the species leap to human beings.e And when they do, as the COVID-19 pandemic illustrated, the interconnectedness of a world in which millions of people fly each day6 means they can spread very rapidly. There is also growing concern about engineered viruses. Not only have advances in synthetic biology (SynBio) created growing capacity for extremely dangerous viruses to be engineered in a laboratory, but the number of people with access to potentially dangerous ‘dual use’ technology has greatly expanded and continues to expand, making malevolent use of such technology ever more likely. In the August 2020 issue of this publication, scientists at the U.S. Military Academy at West Point warned that: The wide availability of the protocols, procedures, and techniques necessary to produce and modify living organisms combined with an exponential increase in the availability of genetic data is leading to a revolution in science affecting the threat landscape that can be rivaled only by the development of the atomic bomb. As the technology improves, the level of education and skills necessary to engineer biological agents decreases. Whereas only state actors historically had the resources to develop and employ biological weapons, SynBio is changing the threat paradigm. The cost threshold of engineering viruses is also lowering, with the West Point scientists warning that synthetic biology has “placed the ability to recreate some of the deadliest infectious diseases known well within the grasp of the state-sponsored terrorist and the talented non-state actor.”7 As already noted, another source of vulnerability is that deadly viruses could be stolen from or escape from a research laboratory. There are now around 50 Biosafety Level 4f facilities around the world, where the deadliest pathogens are stored and worked on, and this figure is set to increase in the next few years.g This is a large increase over the last 30 years, creating bigger risk of a breach. Of equal, if not greater concern are the thousands of Biosafety Level 3 labs globally,8 which handle deadly pathogens like COVID-19.9 Given what has been outlined above, the risk of a future destructive biological attack or another devastating global pandemic should no longer be seen as low. From this point forward, there should no higher priority for the international community than biosecurity. Hamish de Bretton-Gordon Improving Biosecurity

#### 2-- Only cooperating internationally with NATO prevents a biological arm’s race that increases the risk of disease outbreak

Steve Fyffe 15**,** 12-17-2015, Steve earned his Master of Journalism degree from UC Berkeley, and served in several senior communications roles at Stanford University "U.S. Needs a New Approach for Governance of Risky Research," No Publication, <https://cisac.fsi.stanford.edu/news/us-needs-new-approach-governance-risky-research>//AL

The United States needs to build a better governance regime for oversight of risky biological research to reduce the likelihood of a bioengineered super virus escaping from the lab or being deliberately unleashed, according to an article from three Stanford scholars published in the journal Science today. "We've got an increasing number of unusually risky experiments, and we need to be more thoughtful and deliberate in how we oversee this work," said co-author David Relman, a professor of infectious diseases and co-director of Stanford's Center for International Security and Cooperation (CISAC). Relman said that cutting-edge bioscience and technology research has yielded tremendous benefits, such as cheap and effective ways of developing new drugs, vaccines, fuels and food. But he said he was concerned about the growing number of labs that are developing novel pathogens with pandemic potential. For instance, researchers at the Memorial Sloan Kettering Cancer Center, in their quest to create a better model for studying human disease, recently deployed a gene editing technique known as CRISPR-Cas9 on a respiratory virus so that it was able to edit the mouse genome and cause cancer in infected mice. "They ended up creating, in my mind, a very dangerous virus and showed others how they too could make similar kinds of dangerous viruses," Relman said. Scientists in the United States and the Netherlands, conducting so-called "gain-of-function" experiments, have also created much more contagious versions of the deadly H5N1 bird flu in the lab. Publicly available information from published experiments like these, such as genomic sequence data, could allow scientists to reverse engineer a virus that would be difficult to contain and highly harmful were it to spread. And a recent spate of high-profile accidents at U.S. government labs – including the mishandling of anthrax, bird flu, smallpox and Ebola samples – has raised the specter of a dangerous pathogen escaping from the lab and causing an outbreak or even a global pandemic. "These kinds of accidents can have severe consequences," said Megan Palmer, CISAC senior research scholar and a co-author on the paper. "But we lack adequate processes and public information to assess the significance of the benefits and risks. Unless we address this fundamental issue, then we're going to continue to be reactive and make ourselves more vulnerable to mistakes and accidents in the long term." Centralizing leadership Leadership on risk management in biotechnology has not evolved much since the mid-1970s, when pioneering scientists gathered at the Asilomar Conference on Recombinant DNA and established guidelines that are still in use today. Palmer said that although scientific self-governance is an essential element of oversight, left unchecked, it could lead to a "culture of invincibility over time." "There's reliance on really a narrow set of technical experts to assess risks, and we need to broaden that leadership to be able to account for the new types of opportunities and challenges that emerging science and technology bring," she said. Relman described the current system as "piecemeal, ad hoc and uncoordinated," and said that a more "holistic" approach that included academia, industry and all levels of government was needed to tackle the problem. "It's time for us as a set of communities to step back and think more strategically," Relman said. The governance of "dual use" technologies, which can be used for both peaceful and offensive purposes, poses significant challenges in the life sciences, said Stanford political scientist Francis Fukuyama, who also contributed to the paper. "Unlike nuclear weapons, it doesn't take large-scale labs," Fukuyama said. "It doesn't take a lot of capacity to do dangerous research on biology." The co-authors recommend appointing a top-ranking government official, such as a special assistant to the president, and a supporting committee, to oversee safety and security in the life sciences and associated technologies. They would coordinate the management of risk, including regulatory authorities needed to ensure accountability and information sharing. "Although many agencies right now are tasked with worrying about safety, they have got conflicting interests that make them not ideal for being the single point of vigilance in this area," Fukuyama said. "The National Institutes of Health is trying to promote research but also stop dangerous research. Sometimes those two aims run at cross-purposes. "It's a big step to call for a new regulator, because in general we have too much regulation, but we felt there were a lot of dangers that were not being responded to in an appropriate way." Improving cooperation Strong cooperative international mechanisms are also needed to encourage other countries to support responsible research, Fukuyama said. "What we want to avoid is a kind of arms race phenomenon, where countries are trying to compete with each other doing risky research in this area, and not wanting to mitigate risks because of fears that other countries are going to get ahead of them," he said. The co-authors also recommended investing in research centers as a strategic way to build critical perspective and analysis of oversight challenges as biotechnology becomes increasing accessible.

#### Rapidly adapting innovation is the only thing that can solve for the inevitable increased risk of disease outbreak

Jeff, Tollefson, 20. "Why deforestation and extinctions make pandemics more likely." Nature, vol. 584, no. 7820, 13 Aug. 2020, pp. 175+. Gale Academic OneFile, link.gale.com/apps/doc/A632281042/AONE?u=umuser&sid=googleScholar&xid=1b0801f0. Accessed 24 June 2022//AL

As humans diminish biodiversity by cutting down forests and building more infrastructure, they're increasing the risk of disease pandemics such as COVID-19. Many ecologists have long suspected this, but a new study helps to reveal why: while some species are going extinct, those that tend to survive and thrive -- rats and bats, for instance -- are more likely to host potentially dangerous pathogens that can make the jump to humans. The analysis of around 6,800 ecological communities on 6 continents adds to a growing body of evidence that connects trends in human development and biodiversity loss to disease outbreaks -- but stops short of projecting where new disease outbreaks might occur. "We've been warning about this for decades," says Kate Jones, an ecological modeller at University College London and an author on the study, published on 5 August in Nature 1 . "Nobody paid any attention." Jones is one of a cadre of researchers that has long been delving into relationships among biodiversity, land use and emerging infectious diseases. Their work has mostly flown below the radar, but now, as the world reels from the COVID-19 pandemic, efforts to map risks in communities across the globe and to project where diseases are most likely to emerge are taking centre stage. Last week, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) hosted an online workshop on the nexus between biodiversity loss and emerging diseases. The organization's goal now is to produce an expert assessment of the science underlying that connection ahead of a United Nations summit in New York that's planned for September, where governments are expected to make new commitments to preserve biodiversity. Others are calling for a more wide-ranging course of action. On 24 July, an interdisciplinary group of scientists, including virologists, economists and ecologists, published an essay in Science 2 , arguing that governments can help reduce the risk of future pandemics by controlling deforestation and curbing the wildlife trade, which involves the sale and consumption of wild -- and often rare -- animals that can host dangerous pathogens. Most efforts to prevent the spread of new diseases tend to focus on vaccine development, early diagnosis and containment, but that's like treating the symptoms without addressing the underlying cause, says Peter Daszak, a zoologist at the non-governmental organization EcoHealth Alliance in New York, who chaired the IPBES workshop. He says COVID-19 has helped to clarify the need to investigate biodiversity's role in pathogen transmission. The latest work by Jones's team bolsters the case for action, Daszak says. "We're looking for ways to shift behaviour that would directly benefit biodiversity and reduce health risks." Concentrating risk Previous research has shown that outbreaks of diseases such as severe acute respiratory syndrome (SARS) and bird influenza that cross over from animals to humans have increased in the past few decades3 , 4 . This phenomenon is likely to be the direct result of increased contact between humans, wildlife and livestock, as people move into undeveloped areas. These interactions happen more frequently on the frontier of human expansion because of changes to the natural landscape and increased encounters with animals. A study published in April by researchers at Stanford University in California found that deforestation and habitat fragmentation in Uganda increased direct encounters between primates and people, as primates ventured out of the forest to raid crops and people ventured in to collect wood5 . But a key question over the past decade has been whether the decline in biodiversity that inevitably accompanies human expansion on the rural frontier increases the pool of pathogens that can make the jump from animals to humans. Work by Jones and others6 suggests that the answer in many cases is yes, because a loss in biodiversity usually results in a few species replacing many -- and these species tend to be the ones hosting pathogens that can spread to humans. For their latest analysis, Jones and her team compiled more than 3.2 million records from several hundred ecological studies at sites around the world, ranging from native forests to cropland to cities. They found that the populations of species known to host diseases transmissible to humans -- including 143 mammals such as bats, rodents and various primates -- increased as the landscape changed from natural to urban, and as biodiversity generally decreased. The next step for Jones's team is to examine the likelihood of disease transmission to the human population. The group has already made this type of evaluation for Ebola virus outbreaks in Africa, creating risk maps based on development trends, the presence of probable host species, and socio-economic factors that determine the pace at which a virus might spread once it enters the human population7 . The group's risk maps accurately captured where outbreaks occurred in the Democratic Republic of the Congo (DRC) in the past few years, suggesting that it is possible to understand and project risks on the basis of relationships between factors such as land use, ecology, climate and biodiversity. Some researchers urge caution when communicating that biodiversity hotspots are where outbreaks are likely to occur. "My worry, frankly, is that people are going to cut down the forests more if this is where they think the next pandemic is going to come from," says Dan Nepstad, a tropical ecologist and founder of the Earth Innovation Institute based in San Francisco, California, a non-profit organization that campaigns for sustainable development. Efforts to preserve biodiversity will only work, he says, if they address the economic and cultural factors that drive deforestation and the rural poor's dependency on hunting and trading wild animals. Ibrahima Socé Fall, an epidemiologist and head of emergency operations at the World Health Organization in Geneva, Switzerland, agrees that understanding the ecology -- as well as the social and economic trends -- of the rural frontier will be crucial to projecting the risk of future disease outbreaks. "Sustainable development is crucial," he says. "If we continue to have this level of deforestation, disorganized mining and unplanned development, we are going to have more outbreaks." Coordinating efforts One message that the IPBES's upcoming report is likely to deliver is that scientists and policymakers need to treat the rural frontier more holistically, addressing issues of public health, the environment and sustainable development in tandem. In the wake of the COVID-19 pandemic, many scientists and conservationists have emphasized curbing the wildlife trade -- an industry worth an estimated US$20 billion annually in China, where the first coronavirus infections appeared. China has temporarily suspended its trade. But Daszak says the industry is just one piece in a larger puzzle that involves hunting, livestock, land use and ecology. Wildlife markets like this one in Bali, Indonesia, sustain the livelihoods of many people. But they are also under scrutiny as hotspots for pathogen transmission. Credit: Amilia Roso/The Sydney Morning Herald via Getty Live animals, including local wildlife, are on sale in Bali, Indonesia "Ecologists should be working with infectious-disease researchers, public-health workers and medics to track environmental change, assess the risk of pathogens crossing over and reduce risky human activities," he says. Daszak was an author of last month's essay in Science , which argued that governments could substantially reduce the risk of future pandemics such as COVID-19 by investing in efforts to curb deforestation and the wildlife trade, as well as in efforts to monitor, prevent and control new virus outbreaks from wildlife and livestock. The team estimated that the cost of these actions would ring in at $22 billion to $33 billion annually, including $19.4 billion for ending trade in wild meat in China -- a step that not all experts think is desirable or necessary -- and up to $9.6 billion to help curb tropical deforestation. The total investment would be two orders of magnitude less than the $5.6-trillion price tag estimated for the COVID-19 pandemic, the team estimates. Fall says the key is to align efforts by government and international agencies focused on public health, animal health, the environment and sustainable development. The latest Ebola outbreak in the DRC, which began in 2018 and ended last month, had its roots not just in disease but also in deforestation, mining, political instability and the movement of people. The goal must be to focus resources on the riskiest areas and manage interactions between people and animals, both wild and domestic, Fall says. With the right collaboration between human health, animal health and environmental authorities, Fall says, "you have some mechanisms for early warnings".

#### Disease causes extinction

Dimandis 21 (Eleftherios P. Diamandis, “The Mother of All Battles: Viruses vs. Humans. Can Humans Avoid Extinction in 50-100 Years?”, PrePrints 2021040397, April 13th 2021, <https://www.preprints.org/manuscript/202104.0397/v1>, wcNS)

The recent SARS-CoV-2 pandemic, which is causing COVID 19 disease, has taught us unexpected lessons about the dangers of human extinction through highly contagious and lethal diseases. As the COVID 19 pandemic is now being controlled by various isolation measures, therapeutics and vaccines, it became clear that our current lifestyle and societal functions may not be sustainable in the long term. We now have to start thinking and planning on how to face the next dangerous pandemic, not just overcoming the one that is upon us now. Is there any evidence that even worse pandemics could strike us in the near future and threaten the existence of the human race? The answer is unequivocally yes. It is not necessary to get infected by viruses of bats, pangolins and other exotic animals that live in remote forests in order to be in danger. Creditable scientific evidence indicates that the human gut microbiota harbor billions of viruses which are capable of affecting the function of vital human organs such as the immune system, lung, brain, liver, kidney, heart etc. It is possible that the development of pathogenic variants in the gut can lead to contagious viruses which can cause pandemics, leading to destruction of vital organs, causing death or various debilitating diseases such as blindness, respiratory, liver, heart and kidney failures. These diseases could result n the complete shutdown of our civilization and probably the extinction of human race. In this essay, I will first provide a few independent pieces of scientific facts and then combine this information to come up with some (but certainly not all) hypothetical scenarios that could cause human race misery, even extinction. I hope that these scary scenarios will trigger preventative measures that could reverse or delay the projected adverse outcomes. Introduction Le Chatelier’s Principle: Named after the French chemist, Le Chatelier’s principle posits that “When an external stress (change in pressure, temperature or concentration) is applied to a system in chemical equilibrium, the equilibrium will change in such a way as to reduce the effect of the stress”. In other words, a change in a system will evoke a counter-change, which will bring the equilibrium to a new point. This principle operates with almost every human or other activity. For example, it is known that when fruit production in the Serengeti ecosystem is reduced, the number of elephants, who feed on these fruits, is reduced proportionally. In the context of this essay, I hypothesize that human-made changes in climate, the atmosphere, waters, soil and all other planet-living organisms, will likely evoke counter-changes that may be highly consequential to human life. Due to the complexity of our ecosystem, humans do not know exactly how these dramatic changes will affect them in the long run. Consequently, they choose to disregard them because adjustments cost money and convenience or loss of well-established pleasures. The earth is changing rapidly What is changing on earth that could induce a potentially catastrophic counter-change? The answer is everything is changing\*, from the living inhabitants (humans, other species and plants), to the atmosphere, water, soil, climate, etc.

#### Creating room for growth in the biotech sector is key to key to economic resilience---it creates a virtuous cycle of post-COVID growth

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Biotech is now a major contributor to the US economy. When considered as an industry in itself, biotech and its economic impact rivals mining, utilities, chemicals and computing and electronics. Internationally, at least 20 countries have articulated strategies that explicitly identify biotech as critical to their future economic and employment growth (1). Given this focus on economic development, it is crucial to better define the current systemic role of biotech. Moreover, ongoing discussions of funding and investment, benefit and risk, and opportunity and threat all would benefit from a more detailed understanding of where biotech is and where it is headed. In this article, I use data collected from a variety of public and private sources to assemble an initial economic assessment of biotech in the United States as a test case for an analysis at the global level. What emerges is a picture of a sector already making a remarkable and accelerating transformation of the US economy. By my estimate, total domestic US revenues generated by biotech in 2012 reached at least $324 billion--the equivalent of >2% of gross domestic product (GDP; for comparison, see Supplementary Table 1 for a list of selected industries and their contributions to US GDP). The estimate is intended to be conservative; the actual total could be 10-20% higher. Total revenues comprise three biotech subsectors: biologics (drugs), at $91 billion; crops (and seeds), at $128 billion; and industrial products (biofuels, enzymes, biomaterials and biochemicals), at >$105 billion. Over the past decade, aggregate revenues have grown on average at annual rates >10%, much faster than the economy as a whole. Remarkably, biotech revenue growth was the equivalent of >5% of annual US GDP growth every year between 2007 and 2012. It is difficult to project exactly how large the biotech sector might ultimately become, but the trends indicate that biological technologies are likely to generate an increasing share of both GDP and annual GDP growth. Economic and security policy implicationstowards implementation using other successful models outlined in this article.

#### Slow growth deteriorates the international order and prevents cooperation on major existential threats

Haass 17 [Richard Haass, President of the Council on Foreign Relations, previously served as Director of Policy Planning for the US State Department (2001-2003), and was President George W. Bush's special envoy to Northern Ireland and Coordinator for the Future of Afghanistan.] “A World in Disarray: American Foreign Policy and the Crisis of the Old Order”

A large portion of the burden of creating and maintaining order at the regional or global level will fall on the United States. This is inevitable for several reasons, only one of which is that the United States is and will likely remain the most powerful country in the world for decades to come. The corollary to this point is that no other country or group of countries has either the capacity or the mind-set to build a global order. Nor can order ever be expected to emerge automatically; there is no invisible hand in the geopolitical marketplace. Again, a large part of the burden (or, more positively, opportunity) falls on the principal power of the day. There is more than a little self-interest at stake. The United States cannot remain aloof, much less unaffected by a world in disarray. Globalization is more reality than choice. At the regional level, the United States actually faces the opposite problem, namely, that certain actors do have the mind-set and means to shape an order. The problem is that their views of order are in part or in whole incompatible with U.S. interests. Examples would include Iran and ISIS in the Middle East, China in Asia, and Russia in Europe. It will not be an easy time for the United States. The sheer number and range of challenges is daunting. There are a large number of actors and forces to contend with. Alliances, normally created in opposition to some country or countries, may not be as useful a vehicle in a world in which not all foes are always foes and not all friends are always friendly. Diplomacy will count for a great deal; there will be a premium on dexterity. Consultations that aim to affect the actions of other governments and their leaders are likely to matter more than negotiations that aim to solve problems. Another reality is that the United States for all its power cannot impose order. Partially this reflects what might be called structural realities, namely, that no country can contend with global challenges on its own given the very nature of these challenges. The United States could reduce its carbon footprint dramatically, but the effect on global climate would be modest if India and China failed to follow suit. Similarly, on its own the United States cannot maintain a world trading system or successfully combat terrorism or disease. Adding to these realities are resource limits. The United States cannot provide all the troops or dollars to maintain order in the Middle East and Europe and Asia and South Asia. There is simply too much capability in too many hands. Unilateralism is rarely a serious foreign policy option. Partners are essential. That is one of the reasons why sovereign obligation is a desirable compass for U.S. foreign policy. Earlier I made the case that it represents realism for an era of globalization. It also is a natural successor to containment, the doctrine that guided the United States for the four decades of the Cold War. There are basic differences, however. Containment was about holding back more than bringing in and was designed for an era when rivals were almost always adversaries and in which the challenges were mostly related to classical geopolitical competition.1 Sovereign obligation, by contrast, is designed for a world in which sometime rivals are sometime partners and in which collective efforts are required to meet common challenges. Up to this point, we have focused on what the United States needs to do in the world to promote order. That is what one would expect from a book about international relations and American foreign policy. But a focus on foreign policy is not enough. National security is a coin with two sides, and what the United States does at home, what is normally thought of as belonging to the domestic realm, is every bit as much a part of national security as foreign policy. It is best to understand the issue as guns and butter rather than guns versus butter. When it comes to the domestic side, the argument is straightforward. In order to lead and compete and act effectively in the world, the United States needs to put its house in order. I have written on what this entails in a book titled Foreign Policy Begins at Home.2 This was sometimes interpreted as suggesting a turn away from foreign policy. It was nothing of the sort. Foreign policy begins at home, but it ends there only at the country’s peril.3 Earlier I mentioned that the United States has few unilateral options, that there are few if any things it can do better alone than with others. The counterpart to this claim is that the world cannot come up with the elements of a working order absent the United States. The United States is not sufficient, but it is necessary. It is also true that the United States cannot lead or act effectively in the world if it does not have a strong domestic foundation. National security inevitably requires significant amounts of human, physical, and financial resources to draw on. The better the United States is doing economically, the more it will have available in the way of resources to devote to what it wants and needs to do abroad without igniting a divisive and distracting domestic debate as to priorities. An additional benefit is that respect for the United States and for the American political, social, and economic model (along with a desire to emulate it) will increase only if it is seen as successful. The most basic test of the success of the model will be economic growth. U.S. growth levels may appear all right when compared with what a good many other countries are experiencing, but they are below what is needed and fall short of what is possible. There is no reason why the United States is not growing in the range of 3 percent or even higher other than what it is doing and, more important, not doing.4

#### Only opening communication on biotech increase’s NATO’s soft power which increases its global diplomatic ability

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The term “public diplomacy” contains the word “diplomacy.” As an instrument of statecraft, diplomacy has long been used as a tool by states in their relations with other states. Although it does not have a commonly agreed-upon definition, diplomacy is generally considered to be the conduct and management of relations, through peaceful means, by and among international actors. The major international actors are states, and diplomacy mainly involves relations among states or between states, international organizations and other international actors. Today, diplomacy continues to be conducted mainly by states, but also includes international and regional organizations, multinational corporations, non-governmental organizations (NGOs) and even individuals. Since the number and types of actors involved in international affairs have expanded, and the interaction among these actors has increased, the agenda and conduct of diplomacy has evolved in line with these developments. The expansion of intergovernmental and regional organizations does not mean the weakening of diplomacy, but rather a shift from traditional state diplomacy to new forms. Especially in today’s world, international and regional organizations generally compete for better visibility, and they consider their image, identity and brand important. As a collective defense and security organization, NATO has defined itself as the security branch of an institution of liberal-democratic norms and values, and has embraced the main principles of the Western world since its foundation in April 1949. Nonetheless, after the end of the Cold War and the disappearance of the Soviet threat, there emerged deep disagreements about the future role of the Alliance. In today’s global information environment, it is apparent that NATO needs to strengthen its communication tools and approaches, consider public audiences and develop its agenda setting according to the current communication challenges and opportunities. Accordingly, the main purpose of this paper is to understand and interpret the evolution of NATO’s public diplomacy efforts, taking into account the opportunities and limitations of today’s globalized environment. Public diplomacy is based on the ability of states and non-state actors to better explain their values to the world. It concentrates particularly on “soft power” tools such as science, art, culture, sports and media that enable interaction between societies. As an organization widely associated with security and defense issues, it is important to understand how NATO responds to the developments of today’s diplomatic As an organization widely associated with security and defense issues, it is important to understand how NATO responds to the developments of today’s diplomatic trends with its public diplomacy and communication activities. Cansu GÜLEÇ 102 trends with its public diplomacy and communication activities. Since technology has changed and evolved, NATO’s communication strategies must adjust to new types of networks and platforms. Having recently celebrated its 70th anniversary, and now in its 72nd year of existence, the Alliance is seeking to develop a contemporary communication policy and to implement it by means of new mechanisms. In this framework, this paper will first present a working definition of the concept of public diplomacy; next, the historical evolution of NATO’s public diplomacy agenda will be evaluated. Then, NATO’s coordination activities, its values, its practical means of communication and their expected impact will be discussed. The aim of this study is to explore the effects of the opportunities and challenges of the contemporary international environment on NATO’s public diplomacy efforts. Definition and Evolution of Public Diplomacy Diplomacy is derived from a Greek word diploma that means an official document or state paper. The Oxford dictionary defines diplomacy as “management of a country’s affairs by its agents abroad and the activity of managing relations between different countries.”1 As a key process of communication and negotiation in world politics and an important policy device used by international actors, the term diplomacy has been given a number of definitions in International Relations discipline. While some definitions associate diplomacy with the activity of engaging in foreign policy, others use the term to refer to a tool or technique of foreign policy. Accordingly, the term is therefore described as “a foreign policy instrument for establishing and developing peaceful relations between the governments of the various states through the use of intermediaries mutually recognized by the respective parties.” 2 As one of the oldest instruments of world politics, diplomacy is seen as an art, specifically the art of managing relations among sovereign actors. Originally, diplomacy was considered an instrument used by states in order to deal with other states. After the establishment of international and regional organizations, these entities too became involved in diplomatic practices. It can be stated that communication is the focus of diplomacy in managing relations among different international actors. In order to create effective communication mechanisms among different players, diplomacy is supported by an established body of rules and practices.3 Since diplomacy is based on the conduct of relationships using peaceful means, these rules and practices should be implemented by governments and other international actors alike. In practice, diplomacy aims to create a favorable image of the global actor. Modern communication, in that sense, functions to shape views and perceptions around the world. NATO and Public Diplomacy: Opportunities and Constraints of 21st Century 103 In contemporary global environment, although states and governments remain the main actors within the international system, the number and variety of actors, from governments to regional and intergovernmental organizations, multinational corporations and NGOs, have been rapidly expanding. In tandem, the domain and scope of the diplomacy have expanded to involve different sectors that expand beyond traditional high foreign policy issues. Globalization with its the complex web of interdependence has increased the range of negotiations, especially in multilateral meetings.4 Under these circumstances, diplomatic activities require the use of diplomatic tools to directly influence the people of nations as well. In that respect, public diplomacy can be regarded as one of the efficient means of diplomacy in use today. Thanks to this tool, relations between states and global actors progress more peacefully, with inclusion of public opinion alongside that of official representatives. The term ‘public diplomacy’ was first coined in 1965 by Edmund Gullion. According to Gullion, public diplomacy is concerned with the influence of social viewpoints have on the formulation and implementation of foreign policy.5 Indeed, the rise of the concept of public diplomacy is best understood in terms of its relationship with soft power. As mentioned above, with the increase in numbers and types of actors, with the expansion of the subject matter or content of diplomacy, and with the change in the modes, types, and techniques of diplomacy, a new terminology of Public Diplomacy as the language of prestige and international image has brought the concepts like soft power and branding to the nation states’ agenda.6 In IR discipline, power is generally defined as the ability to affect others to obtain desired outcomes. According to Joseph Nye, others’ behavior can be affected in three main ways: threats of coercion; inducements and payments; and attraction that makes others want what you want.7 While discussing the concept, Nye puts a distinction between hard power and soft power.8 The former is achieved through military threat or use, and by economic menace or reward. However, in the 21st century, under the influence of technological developments and globalization, international politics is also changing, and a state cannot address its problems or achieve all of its goals by acting alone. In this environment, it is important to set the agenda and attract others in world politics, as it is not always feasible or desirable to force them to change by means of threats or the use of military or economic weapons. In that sense, ‘soft power’ co-opts people rather than coerces them. Nye coined the ‘soft power’ as “the ability of affect others to obtain the outcomes one wants through attraction rather than coercion or payment.”9 While military force remains the fundamental form of power in international system, abilities like communication, organizational and institutional skills, have also become important instruments in today’s global environment of growing interdependence.10 Diplomacy is a crucial instrument enabling allies to cooperate, and adversaries to resolve conflicts without Cansu GÜLEÇ 104 using force. International actors communicate, influence one another, bargain and adapt their differences through diplomacy. As a key process of communication and negotiation, diplomacy is used as a significant policy instrument by global actors. Today, diplomacy takes place between actors with a wide range of authority, power, tools and impact. A country’s soft power capacity has a crucial role in the success of an actor’s public diplomacy as much as efficacy of its policies; indeed, a country’s political values, culture and foreign policies are important indicators of its soft power.11 Credibility is the significant source of soft power. Since reputation has become one of the main objectives of today’s global actors, they make efforts to increase their credibility around the world. States compete with other states, and also with other actors including media, NGOs, international organizations and other networks in the quest to gain and maintain credibility.12 Public diplomacy is about relationship building. It is about understanding the requirements of other countries, cultures and people; communicating one’s perspectives; correcting misperceptions; and searching areas of common ground.13 Nye defines public diplomacy as an instrument that governments use to mobilize these resources to communicate with and attract the public of other countries, rather than only their governments. Public diplomacy seeks to attract by bringing attention to potential areas of commonality, interest and attraction through broadcasting, supporting cultural initiatives and organizing exchanges.14 The main distinction between traditional and public diplomacy is that the latter involves a much broader group of people on both sides, and a wider set of interests that go beyond those of the government of the day.15 Listening, advocacy, cultural diplomacy, exchange, and international broadcasting are five components of public diplomacy.16 Understanding, planning and engagement are also very important concepts for the establishment of powerful relationships. In the 20th century, public diplomacy was considered a state-based tool used by foreign ministries and other governmental entities to engage and persuade foreign publics with the aim of influencing their governments. Today, public diplomacy has become an instrument used by states, associations of states, and some sub-state and non-state actors to understand cultures, attitudes and behavior; to build and manage relationships; and to influence thoughts and mobilize actions to advance their interests and values.17 A country’s soft power capacity has a crucial role in the success of an actor’s public diplomacy as much as efficacy of its policies; indeed, a country’s political values, culture and foreign policies are important indicators of its soft power. NATO and Public Diplomacy: Opportunities and Constraints of 21st Century 105 Public diplomacy is a process of creating an overall international image that strengthens a country’s ability in order to achieve diplomatic success. This is also important for “propaganda.” Propaganda is an attempt to influence another country through emotional techniques rather than minds by creating fear, doubt, sympathy, anger or other feelings. In order to change or influence other actors’ opinions, actions or policies, propaganda also operates by means of symbols, such as words, gestures, banners, monuments, music, clothing, etc. Propaganda acquired negative connotations in the 20th century, although it was an effective tool of foreign policy during the First and Second World Wars, as well as the Cold War. During these times, propaganda was associated with manipulating populations at home and abroad.18 Unlike public diplomacy, propaganda is generally not interested in dialogue or any meaningful form of relationship-building.19 The main objective of the propaganda is to influence opinion and behavior of its targeted audience. Although both public diplomacy and propaganda intend to convince people to create a favorable image, the distinction between propaganda and public diplomacy lies in the pattern of communication. In that respect, public diplomacy goes beyond propaganda. It is comprised of what is actually said and done by political figures, as well as practices of promotion and other forms of public relations that are utilized by the business sector.20 In other words, public diplomacy, like propaganda, is about creating influence. However, unlike propaganda, that influence is not a one-way street from the speakers to their target audience. Public diplomacy is perceived as a two-way street with a process of mutual influence, in which the foreign public is seen as an active participant.21 In that sense, the objective of public diplomacy is not propaganda, but building a strategic language of communication based on objective facts and truth. Nye asserts that if public diplomacy degenerates into propaganda, it not only fails to convince, but can undercut soft power. Since soft power depends upon an understanding of the minds of others, an efficient public diplomacy is regarded as a two-way street.22 After the end of the Second World War in 1945, a new type of conflict emerged between the U.S. and the Soviet Union, known as the Cold War. The Cold War was based on a contest of ideologies that divided the world into a bipolar competition characterized by a war of words and the threatened use of nuclear weapons, rather than their actual use. In that era, the idea of nuclear war was ever-present in the minds of the international public. U.S.-Soviet relations became the main global, political agenda, and the erection of the Berlin Wall in 1961 became the symbol of a world separated by the “Iron Curtain.”23 Moreover, in both the U.S. and the Soviet Union, and in their alliance blocs of NATO and the Warsaw Pact, the objective was to convince people that fear of the enemy was genuine, legitimate and justified. This, in turn, would legitimate and justify the need to sustain a Cansu GÜLEÇ 106 nuclear arsenal that would have to be at least equal to that of the other side, although there might never be a use for it. This climate of fear was also played out in the media. Propaganda exploited these fears, and the ‘other side’ had always to be portrayed as aggressive, militaristic and repressive.24 In other words, during the Cold War period, propaganda had a special importance in the foreign policy objectives of the U.S. and the USSR. Both used an organized form of propaganda activities with one-sided, deformed messages, mainly based on their respective ideologies; while the U.S. underlined the material prosperity of the Western world and the desirability of individual freedoms, the USSR emphasized the adverse sides of capitalism. This kind of propaganda sought to stress the admirable side of one’s own country, while denigrating the other side by focusing on specific issues.25 In order to shape public attitudes all over the world toward their respective ideologies, the main tools used by the two superpowers were international broadcasting and radio stations, such as the Voice of America (VOA), Radio Liberty and Radio Free Europe on the American side, and Radio Moscow on the Soviet side.26 The U.S. government developed a number of propaganda channels through the work of the United States Information Agency (USIA), and promoted the universal attractiveness of such American brands as Coca-Cola, Levi jeans and McDonalds, as well as American music and Hollywood films. With the end of the bipolar world, the international environment faced new problems with the rapid expansion in the number and scope of interactions. Contemporary challenges emerged in a new, global communication that had different features from that of the Cold War period. Under these circumstances, it can be claimed that the end of the Cold War made public diplomacy much more important. The spread of democracy, media proliferation and the expansion of global NGOs changed the nature of power and now exert much more influence on the freedom of action of national governments than ever before.27 With these developments, public diplomacy has been used in non-traditional forms with new participants, such as non-state actors; with new sorts of relations between state and non-state actors; and with new goals, such as gaining the support of foreign actors to maintain profound relations rather than using propaganda to influence them. The mechanisms used by these actors to communicate with the world public are supported by new, real-time, global technologies, especially by the Internet. These new technologies have blurred the formerly rigid lines between the domestic and international news spheres. A new emphasis has emerged on people-to-people contact for mutual enlightenment, with international actors playing the role of facilitator. Consequently, instead of top-down messaging, “relationship-building” has become the chief task of the new public diplomacy.28 NATO and Public Diplomacy: Opportunities and Constraints of 21st Century 107 Although public diplomacy is accepted as a two-way relationship, there is no agreement on how to measure its impact and success, as there is no clear variable that shows the political outcome of public diplomacy initiatives. However, the establishment of daily communications with the target audience to explain foreign policy decisions and the enhancement of lasting relationships with target groups, including individuals, may help to build relationships and to foster understanding. Since public diplomacy begins with listening, one of the pathways of understanding the success of its activities is to measure “public opinion” to see the largest impact of the attraction. In that sense, successful public diplomacy projects increase favorable public opinion toward the practitioner actor. Another pathway for understanding an initiative’s success is “agenda setting,” which determines the issues covered in the media or discussed in the target population. “Framing” is yet another pathway that changes the media coverage of the practitioner actor’s foreign policy in the host country.29 In sum, public diplomacy increases people’s familiarity with one’s country or international institution by making them think about it, update their image of it and change negative opinions. It also increases people’s appreciation of one’s country or international institution by creating positive perceptions, getting others to see issues of global importance from the same perspective. Moreover, it also helps strengthen ties by getting people to understand and subscribe to common values. More importantly, it influences people and/ or politicians by making them favored partners.30

#### Enhanced diplomatic credibility solves every transnational risk

Burns 20, Goodman Family professor of the practice of diplomacy and international relations, is chair of the Harvard Kennedy School’s Program on Transatlantic Relations, director of the Future of Diplomacy Project, and a co-leader of the American Secretaries of State Project (Nicholas, “The Indispensable Power,” *Harvard Magazine*, https://www.harvardmagazine.com/2020/07/features-forum-indispensable-power)//BB

DIPLOMACY has never been so important as now, when we are confronting the most serious crises since the Second World War: the global pandemic and economic collapse. When we emerge finally from the grip of the coronavirus, Americans will need to account for a public-health disaster that has killed well over 100,000 people to date and shuttered nearly every institution in our society (including Harvard) for much of the spring and into the summer. But we’ll also need to look beyond our borders to assess what went wrong globally. Why did the World Health Organization—its long and continuing record of expertise in matters of global health notwithstanding—not press China more aggressively to tell the truth about the virus in early January? How should nations be better prepared for a possible second wave? Can they agree to share a vaccine equitably among the world’s 7.7 billion people? Will the major economies collaborate to prevent the current recession from turning into another Great Depression? The answer to these questions will depend in large measure on our ability to work diplomatically across the world in this multi-front struggle. As a former career Foreign Service officer, I have spent four decades of my professional life representing the United States overseas and teaching about America’s role as the indispensable power in the international arena. For much of that time, the nation leaned heavily on its unmatched military might—during the Cold War, after 9/11, and in the Afghan and Iraq wars. Now, with the spread of the coronavirus to every inhabited continent, diplomacy’s time has come in the reconstruction of a more stable and better world. Unfortunately, restoring the role of U.S. diplomacy won’t be easy. One early casualty of the pandemic is our plummeting credibility as the unmatched global power. For the first time since World War II, America has chosen not to lead in confronting a quintessentially global threat. With American energy and confidence in short supply, President Donald Trump is a spectral figure on the world stage as nations struggle to contain the virus. Instead of leading the G-20 major economies against the contagion, the world has watched an American president castigate China for birthing the “Wuhan Virus,” pin the blame for the failed response on the World Health Organization, and—as one of my European students lamented—fail even to offer a simple word of sympathy in all those endless news conferences to those dying in Italy and Spain and other bedrock allies. Former Secretary of State Colin Powell has long maintained that America should place its diplomats out in front (“on point” in the military vernacular), with the armed forces in reserve, to be used only when diplomacy fails. Powell’s dictum is an important reminder of how the United States should seek to lead in this time of pandemic, for the coronavirus is only one of many among a new type of threat that requires us to lead as much through the power of diplomacy as through that of the military. Many of the students I teach point to transnational threats that affect every nation and person on earth as our greatest challenges: climate change, food and water shortages, narcotics and crime cartels, the lack of cyber security, and pandemics top the list. We cannot succeed in containing them without forming diplomatic alliances among governments, universities, foundations, businesses, and citizens. This new brand of diplomacy is not an alternative to the military but its logical partner in the twenty-first century American arsenal. The military remains essential to fight terrorists, and to counter rivals Russia and China and outlaw governments in North Korea and Iran, but even in these cases we have to have robust diplomacy to achieve our aims. Even if we deployed the full might of the U.S. military to eliminate the North Korean and Iranian nuclear programs, and the regimes that support them, does anyone believe that would, by itself, “solve” the problem? Even in those cases, deft, multilateral diplomacy will have to play a lead role—as recent experience has shown. We can no longer default to force alone, as we have done so often since 9/11. A Foreign Service for 2030 AMERICA’S DIPLOMATIC EFFECTIVENESS rests, in large part, on the women and men of the U.S. Foreign Service—more than 11,000 career officials in more than 280 embassies and consulates and at the State Department in Washington, D.C. They are our primary interface with foreign governments, businesses, and citizens. They adjudicate immigrant and non-immigrant visas and refugee admissions to the United States. They help American businesses overcome barriers to foreign trade and investment. They manage difficult war and peace challenges in every corner of the world—from daily challenges to the most intricate, strategic matters vital to our national security and prosperity. Diplomatic collaboration also underpins our ability to advance the more positive scientific, technological, and societal trends that can sustain the historic alleviation of poverty worldwide, promote women’s rights, and realize the promise of a carbon-free economy. Just when we need to turn to diplomacy, however, the Foreign Service is experiencing one of the greatest crises in its long history. Some of the damage has been caused by prior Democratic as well as Republican administrations. The United States is the only major country that fills a third or more of its ambassadorial assignments with political appointees, often poorly qualified, from outside the career ranks—often depriving the country of the advantages it could secure with expert, professional, nonpartisan diplomatic representation around the world. That mistake has only accelerated, with the current administration appointing the lowest percentage of career ambassadors in more than half a century. Former generals and admirals have been appointed to ambassadorships that would otherwise be filled—as they should be—by civilian officers. The politicization and militarization of our foreign policy by both parties is a genuine problem. More broadly, the Foreign Service has been substantially weakened and is in need of major repair. Even as the Trump administration’s budget requests for the Department of Defense rose from $686 billion to as high as $718 billion during its first two years, it sought to slash the State Department’s budget by up to a third. The administration fired several of America’s most senior and experienced diplomats early in 2017 and sidelined countless others, triggering an exodus of officers of every rank. The president himself has castigated career diplomats as the “Deep State.” Unsurprisingly, morale has crashed and young Americans’ applications for the Foreign Service have fallen to just under 10,000 from a high of 31,000 in 2003—a worrisome indicator that our nation’s ability to attract superb diplomatic talent is being eroded. Re-Imagining American Diplomacy THE KENNEDY SCHOOL launched an ambitious, nonpartisan initiative this winter—A New American Diplomacy for the 21st Century—to address these concerns and spark a national conversation about the future of the Foreign Service. I am working with former Foreign Service colleagues, Ambassadors Nancy McEldowney, Marc Grossman, and Marcie Ries, to issue a major public report after the November presidential election. We have organized online meetings with hundreds of current and former officials, business and nonprofit leaders, and everyday citizens to discuss ways to strengthen the career service. American diplomacy needs a major generational update. Since 9/11, Congress and three administrations have reformed the U.S. military and intelligence services and created the Department of Homeland Security. But collectively, they did little to re-imagine diplomacy’s role in the American arsenal. During the last century, there have been just three efforts to modernize the U.S. diplomatic corps: in 1924, 1946, and 1980 (when Congress passed the last major State Department Authorization Act). In our vastly altered geo-strategic environment, 40 years later, it is time to renew the mission of the Foreign Service. Barack Obama, Benjamin Netanyahu, and Mahmoud Abbas, September 22, 2009, at the Waldorf Astoria, New York City Photograph by John Angelillo-Pool/Getty Images We can mine America’s long diplomatic history for inspiration. Drawing on my own experience, I recall, as a young intern at the U.S. embassy in Mauritania, seeing first-hand the respect and influence President Jimmy Carter earned as the first U.S. leader to make Africa a priority. A decade later, when I served at the National Security Council with responsibility for the Soviet Union, I witnessed President George H.W. Bush negotiate the peaceful end of the Cold War and Bill Clinton consolidate the triumph of democracy over communism. President George W. Bush launched the bipartisan PEPFAR initiative to help in the fight against HIV/AIDs, polio, malaria, and other deadly diseases in Africa, the Caribbean, and elsewhere (a useful precedent when thinking about what it will really take to combat the coronavirus, not only in the developed nations, but in those with far fewer economic and healthcare resources). It was on 9/11, however, as U.S. ambassador to the North Atlantic Treaty Organization, that I learned one of the most powerful lessons about diplomacy. Just a few hours after Al Qaida terrorists attacked the World Trade Center and Pentagon, my phone started to ring at NATO headquarters outside Brussels. My Canadian colleague, David Wright, called first—followed by the ambassadors of the United Kingdom, France, Poland, Germany, Italy, and many others. Each asked, “What can we do to help?” Those were very welcome words on the single darkest day in recent American history. By the next morning, invoking Article 5 of the 1949 NATO Treaty for the first time in history, all of the NATO-allied countries came to the rescue of the United States—lending mighty political and diplomatic support to the military response that would come later. Our allies considered Osama Bin Laden’s attacks on New York and Washington as an attack on them as well. Their militaries all went into Afghanistan with us (the majority remain 19 years later—and they and other partner nations have suffered more than 1,000 combat deaths; we owe them a lot). Contrary to such evidence, the current president believes the United States is strongest when it acts alone—unburdened of allies and partners whom he views as relics of our Cold War past. I lived the history of 9/11 and draw a very different lesson about the value of allies to the United States. Why would we want to live alone in a troubled and dangerous world, without the benefit of friends and allies by our side? Our NATO allies, as well as Japan, South Korea, and Australia, act as multipliers of American power in the world. They provide a lifeline of military, economic, and political support when we often need it most. They represent the great power differential between the United States and our rivals Russia and China, who can count on no such allies when the chips are down. As we recover from two decades of war and COVID-19’s assault on our society and economy, we will need to look at our global role in a new way. The era when America could run the world by fiat has vanished. We are still the strongest economic, military, and technological power—but China, India, and others are gaining on us. We can no longer overpower our adversaries in every crisis. And although we will need to call on the military to defend us in the future, we will more often than not need to outwit and outmaneuver adversaries through the strength of our diplomats and our alliances—not to mention mustering support for those broader, nonmilitary crises we now face, from pandemics to climate change.

#### A cohesive framework that recognizes the agricultural and environmental benefits of biotech is key to overcome status quo regulations

Zilberman and Wessler 22 (David Zilberman and Justus Wessler, David Zilberman is an agricultrual economist and Robinson Chair at the University of California Berkeley, Justus Wessler is a professor and head of Agricultural Economics at Wageningen University, “The Role of Policy in Supporting a Globally Diverse Bio-economy That Mitigates Climate Change and Food Insecurity”, American Enterprise Institute, January 3rd 2022, <https://www.aei.org/research-products/report/the-role-of-policy-in-supporting-a-globally-diverse-bio-economy-that-mitigates-climate-change-and-food-insecurity/>, WC-NAS)

Perhaps the most significant cost of the extensive regulation of agricultural biotechnology is that it has prevented researchers from taking advantage of new biotechnology tools. As a result, the development of auspicious traits of crops and livestock hasn’t materialized. For example, researchers have identified mechanisms to improve the shelf life of crops and enhance animal feed’s digestibility to reduce methane emissions, but they have not yet been adopted. In addition, scientists have identified means for nitrogen fixation and accelerating photosynthesis, further increasing yields and reducing costs and GHG emissions. Unfortunately, there has been underinvestment in developing faster-growing trees or other organisms that sequester carbon because of the low likelihood of application due to regulation. Other examples include developing biopolymers to substitute fossil fuel–based solutions and using genetically modified microorganisms for producing enzymes that more efficiently convert a wide range of biological resources to food, feed, and bio-based materials.8

One avenue to increase the contribution of agriculture to address the challenges ahead is to **streamline and harmonize biotechnology regulation to allow researchers and innovators to take advantage of its potential increasing scale and scope of solutions**. Studies have shown that harmonization of approval processes can substantially reduce approval costs for new technologies and increase the incentives for investment in biological control agents.9 The National Academy of Sciences has shown that modern biotechnologies are not posing additional environmental health risks compared to traditional agricultural foods.10 On the contrary, they can increase crop yields; reduce land, inorganic fertilizer, and pesticide use; and reduce GHG emissions. With enabling regulation, we expect that both the public and private sectors will expand investment in developing these technologies and, most importantly, using them.

#### Global warming causes extinction

Krosofsky 21 (Andrew Krosofsky, “How Global Warming May Eventually Lead to Global Extinction”, Green Matters, March 11th 2021, https://www.greenmatters.com/p/will-global-warming-cause-extinction , WC-NAS)

Life on this planet has gone through many extinction-level events over time. Most of these phenomena were caused by natural, cataclysmic forces beyond the control of any of the lifeforms existing at that time. The current cataclysmic forces anything but natural and they are well within our control. The question is not, "[will global warming cause extinction](https://www.greenmatters.com/p/endangered-vs-extinct-species)?"— it’s, "how can we prevent that inevitability from happening?"

Will global warming cause extinction?

Eventually, yes. Global warming will invariably result in the mass extinction of millions of different species, humankind included. In fact, [the Center for Biological Diversity](https://www.biologicaldiversity.org/programs/climate_law_institute/global_warming_and_life_on_earth/index.html) says that global warming is currently the greatest threat to life on this planet. Global warming causes a number of detrimental effects on the environment that many species won’t be able to handle long-term.

Extreme weather patterns are shifting climates across the globe, eliminating habitats and altering the landscape. As a result, food and fresh water sources are being drastically reduced. Then, of course, there are the rising global temperatures themselves, which many species are physically unable to contend with. Formerly frozen [arctic and antarctic regions are melting](https://www.greenmatters.com/p/arctic-ice-melting), increasing [sea levels](https://www.greenmatters.com/news/2019/01/15/bPhgWvMpZ/oceans-warming-climate-change) and temperatures. Eventually, these effects will create a perfect storm of extinction conditions.

What species will go extinct if global warming continues?

The melting glaciers of the arctic and the searing, unmanageable heat indexes being seen along the Equator are just the tip of the iceberg, so to speak. The species that live in these [climate zones](https://www.greenmatters.com/p/what-is-a-climate-zone) have already been affected by the changes caused by global warming. Take polar bears for example, whose habitats and food sources have been so greatly diminished that they have been forced to range further and further south.

Increased carbon dioxide levels in the atmosphere and oceans have already led to [ocean acidification](https://www.greenmatters.com/p/what-causes-ocean-acidification#:~:text=According%20to%20the%20Natural%20History,for%20some%20species%20to%20survive.). This has caused many species of crustaceans to either adapt or perish and has led to the mass bleaching of more than 50 percent of Australia’s [Great Barrier Reef](https://www.greenmatters.com/p/coral-great-barrier-reef), according to [National Geographic](https://www.nationalgeographic.com/magazine/article/explore-atlas-great-barrier-reef-coral-bleaching-map-climate-change).

### I/L– Carbon neutrality and sustainability

#### Biotechnology is critical to long-term carbon neutrality *and* short-term sustainability measures

USDA 22 (U.S Department of Agriculture, “Biotechnology and Climate Change”, February 22nd 2022, <https://www.usda.gov/topics/biotechnology/climate-change>, WC-NAS

Agricultural biotechnology can be an important tool for addressing the causes and consequences of [climate change](https://www.usda.gov/oce/energy-and-environment/climate) and for achieving important societal goals such as reduced poverty, improved global food security, and reduced environmental impacts from agriculture. That’s why agricultural biotechnology is part of USDA’s toolkit for a healthy planet and sustainable future.

Causes and impacts of climate change

Human influence on the climate through emission of greenhouse gases is clear. In the U.S., agriculture and forestry contributed an estimated 10.5% of greenhouse gas emissions in 2018 ([USDA-ERS](https://www.ers.usda.gov/topics/natural-resources-environment/climate-change/)). Impacts of climate change on agriculture include increased temperatures and increased incidence or severity of extreme weather events.

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Mitigating and adapting to climate change

Agricultural biotechnology provides ways to both mitigate and enhance adaptation to environmental changes. Products developed with agricultural biotechnology may contribute to the reduction of greenhouse gas emissions, such as [cover crops](https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ny/technical/?cid=nrcs144p2_027252) that provide [sustainable biofuels](https://onlinelibrary.wiley.com/doi/10.1111/pbi.13014), fruits and vegetables that [stay fresh longer](https://www.nature.com/articles/s41438-020-00428-4) and reduce [food waste](https://www.usda.gov/foodlossandwaste). Researchers are also developing ways to draw excess carbon dioxide out of the atmosphere with [trees](https://link.springer.com/article/10.1007/s11627-018-9914-1) and even [microbes](https://elifesciences.org/articles/59882).

Using agricultural biotechnology, plant and animal breeders can more quickly develop plants and animals that are adapted to changing environmental conditions, such as drought, increased temperatures, new diseases, and other stressors.

For example, plant breeders are using agricultural biotechnology to develop [drought-tolerant crops](https://link.springer.com/article/10.1007%2Fs11816-020-00598-6) including wheat, rice, tomato, soybean, and cotton. [Drought-tolerant corn](https://www.ers.usda.gov/amber-waves/2019/march/drought-tolerant-corn-in-the-united-states-research-commercialization-and-related-crop-production-practices/), including certain varieties developed with genetic engineering, is already being grown across drought-prone areas in the United States. [Drought-tolerant wheat](https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=19114) is approved for use in Argentina and Brazil.

Animal breeders are using agricultural biotechnology, including genome editing, to develop [heat-tolerant cattle](https://doi.org/10.1016/j.theriogenology.2020.05.010) that are better able to regulate body temperature during hot conditions. These cattle have reduced [heat stress](https://www.ers.usda.gov/amber-waves/2014/november/greater-heat-stress-from-climate-change-could-lower-dairy-productivity/), due to shorter hair and metabolic changes.

Creating a more sustainable world

In addition to helping to mitigate and adapt to climate change, application of agricultural biotechnology can help advance the [sustainability](https://www.usda.gov/oce/sustainability) of food systems. The United States is a leader in agricultural research and development to improve productivity and promote climate-smart use of natural resources in agriculture.

Through evidence-based innovation and science, including agricultural biotechnology, we can expand the toolbox for farmers, fishers, and other producers to produce more with less – less land, less water, fewer inputs and resources. Innovative and creative solutions are necessary for food systems to keep pace with evolving needs and challenges. Increasing agricultural productivity can reduce agriculture’s environmental impacts, and also alleviate poverty, improve food security and nutrition, and raise standards of living.

### I/L– Sustainable Ag

#### Biocrops create a more sustainable agriculture industry– that creates climate change resilience

Dionglay 22 (Clement Dionglay, “5 Ways Biotechnology Crops Slow Down Climate Change”, International Service For The Acquisition of Agri-Biotech Applications”, February 9th 2022, <https://www.isaaa.org/blog/entry/default.asp?BlogDate=2/9/2022>, WC-NAS)

Biotech crops slow down the effects of climate change

Biotechnology offers a solution to reduce greenhouse gases and slow down climate change. Biotech crops for the last 25 years of commercialization have contributed to reducing CO2 emissions and allowed farmers to use environment-friendly energy, less fertilizer and chemical pesticides, and practice soil carbon sequestration. Here are five solutions that biotechnology offers to slow down climate change.

1. Herbicide tolerant biotech crops

Herbicide tolerant (HT) biotech crops are vital to farmers' fight against weeds. HT crops tolerate exposure to broad-spectrum herbicides such as glyphosate and glufosinate. These crops are compatible with no-till methods, which help preserve the topsoil.

HT biotech crops facilitate zero or no-till farming, which significantly reduces the loss of carbon from the soil (carbon sequestration), CO2 emissions, and fuel use, and prevents soil erosion. [A study](https://www.mdpi.com/2071-1050/13/21/11679/htm) conducted at the University of Saskatchewan, Canada in 2021 reports that HT biotech crops increase soil carbon sequestration, keeping CO2 in the ground instead of releasing it into the atmosphere. HT biotech crops help farmers and the environment as they require less labor and fewer resources for fossil fuel for tractors that plow the soil. Since their introduction, herbicide tolerance technology has helped millions of farmers who plant HT biotech crops. In 2019, [ISAAA reported](https://www.isaaa.org/resources/publications/briefs/55/default.asp) that herbicide tolerance trait was the second most dominant trait deployed in soybeans, maize, canola, cotton, sugar beets, and alfalfa, occupying 81.5 million hectares.

2. Insect resistant biotech crops

Insect pests cause significant damage to crops, reducing yields and prompting farmers to continually spray their plants with pesticides. Excessive use of these pesticides is harmful to humans and the environment so scientists developed insect resistant (IR) biotech crops using a gene from the soil bacterium Bacillus thuringiensis. Insect resistant biotech crops, first introduced in maize (corn) and cotton in the mid-1990s, require fewer pesticide sprays, which results in savings of tractor/fossil fuel and thus less CO2 is released into the atmosphere.

According to the 2018 [PG Economics study](https://pgeconomics.co.uk/press+releases/25/Crop+biotechnology+continues+to+provide+higher+farmer+income+and+significant+environmental+benefits) by Graham Brookes and Peter Barfoot, planting IR biotech crops has helped save 776 million kg. a.i. of pesticides in 1996-2018 and by 51.7 million kg in 2018 alone from being released into the environment. In 2019, ISAAA reported that IR biotech crops were[planted in 23.6 million hectares](https://www.isaaa.org/resources/publications/briefs/55/default.asp) in India, Brazil, China, Pakistan, USA, Myanmar, South Africa, Sudan, Malawi, Nigeria, Spain, Portugal, Bangladesh, Eswatini, and Ethiopia. Brookes and Barfoot report that globally in 2018, the farm-level impact of using IR biotech cotton was US$4.38 billion and US$3.37 billion for IR biotech maize.

3. Salinity tolerant crops

Biotech salt tolerant crops have been developed in countries such as the USA, China, and Australia, and some are currently undergoing field trials. In Australia, field trials of 1,161 lines of genetically modified (GM) wheat and 1,179 lines of GM barley modified to contain one of 35 genes obtained from wheat, barley, maize, thale cress, moss, or yeasts were conducted in 2010-2015. Some of the genes are expected to enhance tolerance to drought, cold, salinity, and low phosphorous. Sugarcane that contains a transcription factor (OsDREB1A) also completed field trial in 2015.

Genes influencing salt tolerance have been found in various plants. In 2019, scientists at the University of Western Australia [discovered two enzymes](https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=17358) that explain wheat's sensitivity to salty soils. In 2020, scientists from China National Rice Research Institute [identified a gene in rice](https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=17910) that influences sugar metabolism as well as the plant's response to salinity stress. Similarly, [a team from the US and South Korea](https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=18206) has engineered thale cress to behave like a succulent with improved water-use efficiency, and salinity tolerance by overexpressing a gene involved in berry development in wine grapes.

4. Drought resistant crops

Agriculture is the largest consumer of water in the world, and in many developing countries, the use of water for agriculture can exceed 90% of consumption. The scarcity of water presents a major disaster worldwide, and droughts have caused significant yield losses in recent years. Drought tolerant biotech crops carrying genes for water-stress management have been developed by scientists as a solution to yield losses due to drought.

In 2019, soybean varieties carrying the [drought-tolerant HB4® trait](https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=16716) were introduced in Argentina. HB4® soybeans deliver two layers of value for farmers as they are both drought and herbicide tolerant. The [HB4® technology](https://www.isaaa.org/gmapprovaldatabase/event/default.asp?EventID=403) reduces yield loss when the crop is challenged by [drought](https://www.isaaa.org/resources/publications/pocketk/32/default.asp). The [US approval](https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=17693) for HB4® soybeans followed in the same year, with the [approval in Canada](https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=18816) granted in 2021.

In 2020, Argentina became the first country in the world to approve [HB4® drought tolerant wheat](https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=18384) for growth and consumption. The HB4 trait increases wheat yields by up to 20% and is currently the only drought tolerance technology for wheat and soybean crops in the world. In November 2021, Brazil approved [HB4® wheat flour](https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=19114) for animal and human consumption.

5. Cold tolerant crops

Using genetic and molecular approaches, several genes for cold tolerance have been identified in [rice](https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=16076), [sugarcane](https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=12055), [sorghum](https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=10273), and [potatoes](https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=878). Cold tolerant GM crops are being developed such as GM eucalypti, which is currently being field-tested in the US by Arborgen LLC since 2010. Thale cress has been improved to contain the DaIRIP4 from Deschapsia antarctica, a hairgrass that thrives in frosts down to -30C, and sugarcane is being introgressed with genes from cold tolerant wild varieties.

#### Biotech can create more sustainable, efficient, and productive agriculture

Chatterjee 21 (Jayanta Chatterjee, “Developing More Sustainable Global Food Systems Through Agroecology and Biotechnology”, US Department of State, September 30th 2021, <https://www.state.gov/dipnote-u-s-department-of-state-official-blog/developing-more-sustainable-global-food-systems-through-agroecology-and-biotechnology/>, WC-NAS

Agroecological systems are meant to be highly diverse and biotechnology can help keep them diverse.  All breeding techniques depend on diversity, embracing the range of traits found in plants and beyond to develop robust, tasty crops needed to feed our families.  Sometimes these traits already exist in the same or related species and need just a little selective breeding to have the new trait(s) incorporated in that crop, as has been done for [10,000 to 12,000 years](https://www.nationalgeographic.org/article/development-agriculture/), since we invented agriculture.  In other cases, traits need to be shared between two unrelated (sexually incompatible) species, which is accomplished by genetic modification, both naturally or through engineering.  In fact, all plant species naturally have [gained new traits by picking up bacterial genes](https://www.nytimes.com/2019/11/14/science/plant-genes-evolution.html) to survive and thrive on dry land.  Modern biotechnology is helping diversify our diets and adapt to changing conditions.  Purple tomatoes that contain more antioxidants than blueberries, more nutritious and less pungent [kale](https://www.nytimes.com/2021/07/20/magazine/gmos.html), a mustard variety with [zero-erucic and high-oleic acid](https://www.sciencedirect.com/science/article/pii/S2352385918300264) with great health benefits and [nitro-fixing cereal crops](https://news.mit.edu/2020/making-real-biotechnology-dream-nitrogen-fixing-cereal-crops-0110) are just a few examples worth noting.

Agroecology depends on context-specific knowledge.  Co-creation and sharing of knowledge have been essential to our understanding of the biology of living organisms and their interactions at the molecular level.  Research in molecular biology and its application in the form of biotechnology can help to scientifically validate and improve upon immensely powerful traditional and indigenous knowledge while protecting vulnerable ecosystems and promoting biodiversity.  Unfortunately, ideological arguments and unfounded fears often jeopardize scientists’ ability to verify the efficacy, ensure the safety, and demonstrate the benefits of biotechnology.

Improving efficiency is a vital element of agroecology and can be directly strengthened by biotechnology. This could include developing a crop variety that can grow with less water or require significantly less or no chemical pesticide or fertilizer or vegetables or fruits with longer shelf life.  It can also include commonly consumed crops supplemented with needed micro/macro-nutrients like [iron](https://www.frontiersin.org/articles/10.3389/fsufs.2020.571402/full#T1), [zinc](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5790416/#cit0047), vitamins (e.g., [vit A](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5790416/#cit0046), as achieved by Golden Rice) and many other such nutrients via [biofortification](https://www.nature.com/articles/s41467-020-19020-4) through genetic engineering.  All of these innovations increase the efficiency of our agricultural systems.  A recently published [farm level survey in Vietnam](https://pubmed.ncbi.nlm.nih.gov/32997586/)showed that the average amount of herbicide active ingredient applied to the biotech crop area was 26 percent lower and 36 percent lower in terms of environmental impact of the herbicide use as compared to control fields planted with non-biotech crops.

Agroecology places a strong emphasis on human and social values.  Increases in agricultural productivity with the use of biotechnology have resulted in better farmer livelihoods.  In Vietnam, the farmers earned an additional income of $6.84 to $12.55 for every extra $1 spent on biotech seed relative to conventional seed.

In agroecology, recycling means agricultural production with lower economic and environmental costs.  Biodegradable plastic (bio-plastic) is enabled using biotechnology in [bacteria](https://pubmed.ncbi.nlm.nih.gov/30091095/) and increasingly in [plants](https://www.cell.com/trends/plant-science/fulltext/S1360-1385(99)01544-7).  There are many other ways biotechnology can help in recycling not just farm byproducts but also polluted water and [soil via remediation to remove various types of contamination](https://pubmed.ncbi.nlm.nih.gov/28386947/), including heavy metal and petrochemical pollution.

People, communities, and nations show more resilience when their food systems satisfy all the three pillars of sustainability – economic, social, and environmental. Overemphasis on one or two of these pillars can lead to gaps in achieving food security, community development, or biodiversity objectives, especially in many developing countries and farming communities.  Standard organic and regenerative farming practices, which are often equated with agroecological principles, aim to meet resilience and sustainability goals, but there are differences in productivity.

Gaps in productivity have been noted in [Europe](https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/farming/documents/market-brief-organic-farming-in-the-eu_mar2019_en.pdf), particularly important for wheat, with a “yield gaps ranging between 40 percent (Germany) and 85 percent (Italy) of conventional yields.”  Yield loss has also occurred in [tropical countries like Sri Lanka](https://www.sundaytimes.lk/210523/news/agriculture-economists-praise-switch-to-organic-farming-but-concerned-over-blanket-ban-on-chemical-fertiliser-444766.html), which has [banned import of fertilizers and agrochemicals that include insecticides and herbicides](https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Sri%20Lanka%20Restricts%20and%20Bans%20the%20Import%20of%20Fertilizers%20and%20Agrochemicals_New%20Delhi_Sri%20Lanka_05-14-2021.pdf) while trying to shift to organic farming.  In the United States, [costs for organic corn](https://www.ers.usda.gov/data-products/chart-gallery/gallery/chart-detail/?chartId=101938) are estimated to be $83–$98 higher per acre than their conventional counterparts and costs for organic soybeans are estimated at $106–$125 higher.  Buyers must pay a higher price for such organic products.  Farmers producing organic crops need to charge proportionately more to compensate for the yield loss.  Most farmers and other consumers in the world do not have the luxury to buy more expensive food.  Together, agroecology and biotechnology can overcome the gap.

#### A need for massive expansion of ag is coming --- by 2050 we will run out of food if we don’t find new strategies for sustainable farming

Elferink et al ‘16

(Maarten Elferink is the founder and Managing Director of Vosbor, an Amsterdam based commodity service and solutions provider dedicated to sustainability, originating soft commodities and derivative products selectively in Eastern Europe and the FSU for distribution in the Asia-Pacific region, Florian Schierhorn is a post-doctoral researcher at the Leibniz Institute of Agricultural Development in Transition Economies in Halle, Germany and was selected for participation in the Lindau Nobel Laureate Meeting on Economic Sciences in 2014. His overall research relates to the question of how to meet global food security without increasing pressure on land, “Global Demand for Food Is Rising. Can We Meet It?,” pg online @ <https://hbr.org/2016/04/global-demand-for-food-is-rising-can-we-meet-it> //um-ef)

Over the last century, the global population has quadrupled. In 1915, there were 1.8 billion people in the world. Today, according to the most recent estimate by the UN, there are 7.3 billion people — and we may reach 9.7 billion by 2050. This growth, along with rising incomes in developing countries (which cause dietary changes such as eating more protein and meat) are driving up global food demand. Food demand is expected to increase anywhere between 59% to 98% by 2050. This will shape agricultural markets in ways we have not seen before. Farmers worldwide will need to increase crop production, either by increasing the amount of agricultural land to grow crops or by enhancing productivity on existing agricultural lands through fertilizer and irrigation and adopting new methods like precision farming. However, the ecological and social trade-offs of clearing more land for agriculture are often high, particularly in the tropics. And right now, crop yields — the amount of crops harvested per unit of land cultivated — are growing too slowly to meet the forecasted demand for food. Many other factors, from climate change to urbanization to a lack of investment, will also make it challenging to produce enough food. There is strong academic consensus that climate change–driven water scarcity, rising global temperatures, and extreme weather will have severe long-term effects on crop yields. These are expected to impact many major agricultural regions, especially those close to the Equator. For example, the Brazilian state of Mato Grosso, one of the most important agricultural regions worldwide, may face an 18% to 23% reduction in soy and corn output by 2050, due to climate change. The Midwestern U.S. and Eastern Australia — two other globally important regions — may also see a substantial decline in agricultural output due to extreme heat. Yet some places are expected to (initially) benefit from climate change. Countries stretching over northern latitudes — mainly China, Canada, and Russia — are forecasted to experience longer and warmer growing seasons in certain areas. Russia, which is already a major grain exporter, has huge untapped production potential because of large crop yield gaps (the difference between current and potential yields under current conditions) and widespread abandoned farmland (more than 40 million hectares, an area larger than Germany) following the dissolution of the Soviet Union, in 1991. The country arguably has the most agricultural opportunity in the world, but institutional reform and significant investments in agriculture and rural infrastructure will be needed to realize it. Advanced logistics, transportation, storage, and processing are also crucial for making sure that food goes from where it grows in abundance to where it doesn’t. This is where soft commodity trading companies, such as Cargill, Louis Dreyfus, or COFCO, come in. While Big Food companies such as General Mills or Unilever have tremendous global influence on what people eat, trading companies have a much greater impact on food security, because they source and distribute our staple foods and the ingredients used by Big Food, from rice, wheat, corn, and sugar to soybean and oil palm. They also store periodically produced grains and oilseeds so that they can be consumed all year, and they process soft commodities so that they can be used further down the value chain. For example, wheat needs to be milled into flour to produce bread or noodles, and soybeans must be crushed to produce oil or feed for livestock. Nonetheless, even if some regions increase their output and traders reduce the mismatch between supply and demand, doubling food production by 2050 will undeniably be a major challenge. Businesses and governments will have to work together to increase productivity, encourage innovation, and improve integration in supply chains toward a sustainable global food balance. First and foremost, farmers, trading companies, and other processing groups (Big Food in particular) need to commit to deforestation-free supply chains. Deforestation causes rapid and irreversible losses of biodiversity, is the second largest source of carbon dioxide emissions after fossil fuels, and has contributed greatly to global warming—adding to the negative pressure on agriculture production for which these forests were cleared in the first place. Farmers must also grow more on the land they currently operate through what is called “sustainable intensification.” This means using precision farming tools, such as GPS fertilizer dispersion, advanced irrigation systems, and environmentally optimized crop rotations. These methods can help produce more crops, especially in parts of Africa, Latin America, and Eastern Europe with large yield gaps. They can also reduce the negative environmental impacts from over-stressing resources–preventing groundwater depletion and the destruction of fertile lands through over-use of fertilizer. The agricultural sector also needs significant long-term private investment and public spending. Many large institutional investors, including pension funds and sovereign wealth funds, have already made major commitments to support global agricultural production and trading in recent years—not least because agricultural (land) investments have historically delivered strong returns, increased diversification, and outpaced inflation. Still, investment in agriculture in most developing countries has declined over the last 30 years and much less is spent on R&D compared to developed countries—resulting in low productivity and stagnant production. And because banking sectors in developing countries give fewer loans to farmers (compared to the share of agriculture in GDP), investments by both farmers and large corporations are still limited. To attract more financing and investment in agriculture, the risks need to be reduced by governments. Regulators need to overhaul policies that limit inclusion of small, rural farmers into the financial system— for example, soft loans (i.e., lending that is more generous than market lending) and interest rate caps discourage bank lending. More supportive policies, laws, and public spending on infrastructure would help create a favorable investment climate for agriculture.

#### Food insecurity causes extinction

John Castellaw 17, Teaching Fellow at the College of Business and Global Affairs at the University of Tennessee, on the National Security Advisory Council of the U.S. Global Leadership Coalition, former Chief of Staff for the U.S. Central Command, Lieutenant General, Marine Corps (Ret.), 5/1/2017, “Opinion: Food Security Strategy Is Essential to Our National Security”, https://www.agri-pulse.com/articles/9203-opinion-food-security-strategy-is-essential-to-our-national-security

The United States faces many threats to our National Security. These threats include continuing wars with extremist elements such as ISIS and potential wars with rogue state North Korea or regional nuclear power Iran. The heated economic and diplomatic competition with Russia and a surging China could spiral out of control. Concurrently, we face threats to our future security posed by growing civil strife, famine, and refugee and migration challenges which create incubators for extremist and anti-American government factions. Our response cannot be one dimensional but instead must be a nuanced and comprehensive National Security Strategy combining all elements of National Power including a Food Security Strategy.¶ An American Food Security Strategy is an imperative factor in reducing the multiple threats impacting our National wellbeing. Recent history has shown that reliable food supplies and stable prices produce more stable and secure countries. Conversely, food insecurity, particularly in poorer countries, can lead to instability, unrest, and violence.¶ Food insecurity drives mass migration around the world from the Middle East, to Africa, to Southeast Asia, destabilizing neighboring populations, generating conflicts, and threatening our own security by disrupting our economic, military, and diplomatic relationships. Food system shocks from extreme food-price volatility can be correlated with protests and riots. Food price related protests toppled governments in Haiti and Madagascar in 2007 and 2008. In 2010 and in 2011, food prices and grievances related to food policy were one of the major drivers of the Arab Spring uprisings. Repeatedly, history has taught us that a strong agricultural sector is an unquestionable requirement for inclusive and sustainable growth, broad-based development progress, and long-term stability.¶ The impact can be remarkable and far reaching. Rising income, in addition to reducing the opportunities for an upsurge in extremism, leads to changes in diet, producing demand for more diverse and nutritious foods provided, in many cases, from American farmers and ranchers. Emerging markets currently purchase 20 percent of U.S. agriculture exports and that figure is expected to grow as populations boom.¶ Moving early to ensure stability in strategically significant regions requires long term planning and a disciplined, thoughtful strategy. To combat current threats and work to prevent future ones, our national leadership must employ the entire spectrum of our power including diplomatic, economic, and cultural elements. The best means to prevent future chaos and the resulting instability is positive engagement addressing the causes of instability before it occurs.¶ This is not rocket science. We know where the instability is most likely to occur. The world population will grow by 2.5 billion people by 2050. Unfortunately, this massive population boom is projected to occur primarily in the most fragile and food insecure countries. This alarming math is not just about total numbers. Projections show that the greatest increase is in the age groups most vulnerable to extremism. There are currently 200 million people in Africa between the ages of 15 and 24, with that number expected to double in the next 30 years. Already, 60% of the unemployed in Africa are young people. ¶ Too often these situations deteriorate into shooting wars requiring the deployment of our military forces. We should be continually mindful that the price we pay for committing military forces is measured in our most precious national resource, the blood of those who serve. For those who live in rural America, this has a disproportionate impact. Fully 40% of those who serve in our military come from the farms, ranches, and non-urban communities that make up only 16% of our population. ¶ Actions taken now to increase agricultural sector jobs can provide economic opportunity and stability for those unemployed youths while helping to feed people. A recent report by the Chicago Council on Global Affairs identifies agriculture development as the core essential for providing greater food security, economic growth, and population well-being.¶ Our active support for food security, including agriculture development, has helped stabilize key regions over the past 60 years. A robust food security strategy, as a part of our overall security strategy, can mitigate the growth of terrorism, build important relationships, and support continued American economic and agricultural prosperity while materially contributing to our Nation’s and the world’s security.

### I/L– Marine

#### Increasing biotech innovation is key to marine ecosystem conservation and climate resilience

R&R 19 (Revive&Restore, Conservation project that focuses on the genetic rescue of species by partnering with workshops and global experts, “A Call For Biotechnology in Ocean Conservation”, December 5th 2019, <https://reviverestore.org/a-call-for-biotechnology-in-ocean-conservation/>, WC-NAS)

This report is the culmination of nine months of research with over 100 experts in ocean ecology, genomics, and biotechnology. It describes how genomic and biotech innovations—including genomic sequencing, biobanking, advanced reproductive technologies, and genetic engineering—can address some of the ocean’s biggest threats—from coral bleaching and overfishing to invasives and island biodiversity—all-the-while complementing traditional conservation and remediation strategies.

To a roomful of scientists, conservationists, and thinkers, Phelan stated that these “genomic technologies in synthetic biology, by-in-large are highly underutilized by the conservation community, especially when it comes to the ocean.”

Traditional conservation efforts rely heavily on being protected, like California’s Monterey Bay. However, biotechnology must be used to enhance conservation, too, said Phelan.

“It’s really about the culmination of all of these technologies. It’s all the tools that conservation has to offer. We have to protect, absolutely,” she said, then added, “We have to intervene.”

The Ocean Genomics Horizon Scan helped Revive & Restore develop a list of Ten Big Ideas, each one a major opportunity for biotechnology to protect and promote a healthier marine environment. These include:

GENOMICS GUIDING MPA’S

Using genomics, eDNA, and next-generation genetic sequencing to evaluate the biodiversity of an area, said Phelan, can help strengthen the rationale for preserving established MPAs and assess optimal locations for new MPAs.

ADVANCED CORAL TOOLKIT

Today, reefs around the world are threatened by rising temperatures and invasive species. There are more than 650 different types of coral, but less than a dozen coral genomes have been sequenced.  “We’re losing biodiversity before we bank it and before we sequence it,” said Phelan.

Techniques for isolating coral stem cells, a robust library of coral genomes and cryopreserved specimens, plus the ability to induce coral spawning, will all help scientists revive coral reefs in the future, she added.

TARGETING INVASIVES

Additionally, genomic interventions may help species gain a biological advantage to fend off predators, disease, and other threats that are winning out in many weakened ecosystems. These facilitated adaptations could one day help corals fend off the crown of thorns starfish—14 million of which are preying upon the Great Barrier Reef and adding to its destabilization.

### Impact– Climate

#### Warming leads to extinction

Kareiva 18, Ph.D. in ecology and applied mathematics from Cornell University, director of the Institute of the Environment and Sustainability at UCLA, Pritzker Distinguished Professor in Environment & Sustainability at UCLA, et al. (Peter, “Existential risk due to ecosystem collapse: Nature strikes back,” Futures, 102)

In summary, six of the nine proposed planetary boundaries (phosphorous, nitrogen, biodiversity, land use, atmospheric aerosol loading, and chemical pollution) are unlikely to be associated with existential risks. They all correspond to a degraded environment, but in our assessment do not represent existential risks. However, the three remaining boundaries (climate change, global freshwater cycle, and ocean acidification) do pose existential risks. This is because of intrinsic positive feedback loops, substantial lag times between system change and experiencing the consequences of that change, and the fact these different boundaries interact with one another in ways that yield surprises. In addition, climate, freshwater, and ocean acidification are all directly connected to the provision of food and water, and shortages of food and water can create conflict and social unrest. Climate change has a long history of disrupting civilizations and sometimes precipitating the collapse of cultures or mass emigrations (McMichael, 2017). For example, the 12th century drought in the North American Southwest is held responsible for the collapse of the Anasazi pueblo culture. More recently, the infamous potato famine of 1846–1849 and the large migration of Irish to the U.S. can be traced to a combination of factors, one of which was climate. Specifically, 1846 was an unusually warm and moist year in Ireland, providing the climatic conditions favorable to the fungus that caused the potato blight. As is so often the case, poor government had a role as well—as the British government forbade the import of grains from outside Britain (imports that could have helped to redress the ravaged potato yields). Climate change intersects with freshwater resources because it is expected to exacerbate drought and water scarcity, as well as flooding. Climate change can even impair water quality because it is associated with heavy rains that overwhelm sewage treatment facilities, or because it results in higher concentrations of pollutants in groundwater as a result of enhanced evaporation and reduced groundwater recharge. Ample clean water is not a luxury—it is essential for human survival. Consequently, cities, regions and nations that lack clean freshwater are vulnerable to social disruption and disease. Finally, ocean acidification is linked to climate change because it is driven by CO2 emissions just as global warming is. With close to 20% of the world’s protein coming from oceans (FAO, 2016), the potential for severe impacts due to acidification is obvious. Less obvious, but perhaps more insidious, is the interaction between climate change and the loss of oyster and coral reefs due to acidification. Acidification is known to interfere with oyster reef building and coral reefs. Climate change also increases storm frequency and severity. Coral reefs and oyster reefs provide protection from storm surge because they reduce wave energy (Spalding et al., 2014). If these reefs are lost due to acidification at the same time as storms become more severe and sea level rises, coastal communities will be exposed to unprecedented storm surge—and may be ravaged by recurrent storms. A key feature of the risk associated with climate change is that mean annual temperature and mean annual rainfall are not the variables of interest. Rather it is extreme episodic events that place nations and entire regions of the world at risk. These extreme events are by definition “rare” (once every hundred years), and changes in their likelihood are challenging to detect because of their rarity, but are exactly the manifestations of climate change that we must get better at anticipating (Diffenbaugh et al., 2017). Society will have a hard time responding to shorter intervals between rare extreme events because in the lifespan of an individual human, a person might experience as few as two or three extreme events. How likely is it that you would notice a change in the interval between events that are separated by decades, especially given that the interval is not regular but varies stochastically? A concrete example of this dilemma can be found in the past and expected future changes in storm-related flooding of New York City. The highly disruptive flooding of New York City associated with Hurricane Sandy represented a flood height that occurred once every 500 years in the 18th century, and that occurs now once every 25 years, but is expected to occur once every 5 years by 2050 (Garner et al., 2017). This change in frequency of extreme floods has profound implications for the measures New York City should take to protect its infrastructure and its population, yet because of the stochastic nature of such events, this shift in flood frequency is an elevated risk that will go unnoticed by most people. 4. The combination of positive feedback loops and societal inertia is fertile ground for global environmental catastrophes Humans are remarkably ingenious, and have adapted to crises throughout their history. Our doom has been repeatedly predicted, only to be averted by innovation (Ridley, 2011). However, the many stories of human ingenuity successfully addressing existential risks such as global famine or extreme air pollution represent environmental challenges that are largely linear, have immediate consequences, and operate without positive feedbacks. For example, the fact that food is in short supply does not increase the rate at which humans consume food—thereby increasing the shortage. Similarly, massive air pollution episodes such as the London fog of 1952 that killed 12,000 people did not make future air pollution events more likely. In fact it was just the opposite—the London fog sent such a clear message that Britain quickly enacted pollution control measures (Stradling, 2016). Food shortages, air pollution, water pollution, etc. send immediate signals to society of harm, which then trigger a negative feedback of society seeking to reduce the harm. In contrast, today’s great environmental crisis of climate change may cause some harm but there are generally long time delays between rising CO2 concentrations and damage to humans. The consequence of these delays are an absence of urgency; thus although 70% of Americans believe global warming is happening, only 40% think it will harm them (http://climatecommunication.yale.edu/visualizations-data/ycom-us-2016/). Secondly, unlike past environmental challenges, the Earth’s climate system is rife with positive feedback loops. In particular, as CO2 increases and the climate warms, that very warming can cause more CO2 release which further increases global warming, and then more CO2, and so on. Table 2 summarizes the best documented positive feedback loops for the Earth’s climate system. These feedbacks can be neatly categorized into carbon cycle, biogeochemical, biogeophysical, cloud, ice-albedo, and water vapor feedbacks. As important as it is to understand these feedbacks individually, it is even more essential to study the interactive nature of these feedbacks. Modeling studies show that when interactions among feedback loops are included, uncertainty increases dramatically and there is a heightened potential for perturbations to be magnified (e.g., Cox, Betts, Jones, Spall, & Totterdell, 2000; Hajima, Tachiiri, Ito, & Kawamiya, 2014; Knutti & Rugenstein, 2015; Rosenfeld, Sherwood, Wood, & Donner, 2014). This produces a wide range of future scenarios. Positive feedbacks in the carbon cycle involves the enhancement of future carbon contributions to the atmosphere due to some initial increase in atmospheric CO2. This happens because as CO2 accumulates, it reduces the efficiency in which oceans and terrestrial ecosystems sequester carbon, which in return feeds back to exacerbate climate change (Friedlingstein et al., 2001). Warming can also increase the rate at which organic matter decays and carbon is released into the atmosphere, thereby causing more warming (Melillo et al., 2017). Increases in food shortages and lack of water is also of major concern when biogeophysical feedback mechanisms perpetuate drought conditions. The underlying mechanism here is that losses in vegetation increases the surface albedo, which suppresses rainfall, and thus enhances future vegetation loss and more suppression of rainfall—thereby initiating or prolonging a drought (Chamey, Stone, & Quirk, 1975). To top it off, overgrazing depletes the soil, leading to augmented vegetation loss (Anderies, Janssen, & Walker, 2002). Climate change often also increases the risk of forest fires, as a result of higher temperatures and persistent drought conditions. The expectation is that forest fires will become more frequent and severe with climate warming and drought (Scholze, Knorr, Arnell, & Prentice, 2006), a trend for which we have already seen evidence (Allen et al., 2010). Tragically, the increased severity and risk of Southern California wildfires recently predicted by climate scientists (Jin et al., 2015), was realized in December 2017, with the largest fire in the history of California (the “Thomas fire” that burned 282,000 acres, https://www.vox.com/2017/12/27/16822180/thomas-fire-california-largest-wildfire). This catastrophic fire embodies the sorts of positive feedbacks and interacting factors that could catch humanity off-guard and produce a true apocalyptic event. Record-breaking rains produced an extraordinary flush of new vegetation, that then dried out as record heat waves and dry conditions took hold, coupled with stronger than normal winds, and ignition. Of course the record-fire released CO2 into the atmosphere, thereby contributing to future warming. Out of all types of feedbacks, water vapor and the ice-albedo feedbacks are the most clearly understood mechanisms. Losses in reflective snow and ice cover drive up surface temperatures, leading to even more melting of snow and ice cover—this is known as the ice-albedo feedback (Curry, Schramm, & Ebert, 1995). As snow and ice continue to melt at a more rapid pace, millions of people may be displaced by flooding risks as a consequence of sea level rise near coastal communities (Biermann & Boas, 2010; Myers, 2002; Nicholls et al., 2011). The water vapor feedback operates when warmer atmospheric conditions strengthen the saturation vapor pressure, which creates a warming effect given water vapor’s strong greenhouse gas properties (Manabe & Wetherald, 1967). Global warming tends to increase cloud formation because warmer temperatures lead to more evaporation of water into the atmosphere, and warmer temperature also allows the atmosphere to hold more water. The key question is whether this increase in clouds associated with global warming will result in a positive feedback loop (more warming) or a negative feedback loop (less warming). For decades, scientists have sought to answer this question and understand the net role clouds play in future climate projections (Schneider et al., 2017). Clouds are complex because they both have a cooling (reflecting incoming solar radiation) and warming (absorbing incoming solar radiation) effect (Lashof, DeAngelo, Saleska, & Harte, 1997). The type of cloud, altitude, and optical properties combine to determine how these countervailing effects balance out. Although still under debate, it appears that in most circumstances the cloud feedback is likely positive (Boucher et al., 2013). For example, models and observations show that increasing greenhouse gas concentrations reduces the low-level cloud fraction in the Northeast Pacific at decadal time scales. This then has a positive feedback effect and enhances climate warming since less solar radiation is reflected by the atmosphere (Clement, Burgman, & Norris, 2009). The key lesson from the long list of potentially positive feedbacks and their interactions is that runaway climate change, and runaway perturbations have to be taken as a serious possibility. Table 2 is just a snapshot of the type of feedbacks that have been identified (see Supplementary material for a more thorough explanation of positive feedback loops). However, this list is not exhaustive and the possibility of undiscovered positive feedbacks portends even greater existential risks. The many environmental crises humankind has previously averted (famine, ozone depletion, London fog, water pollution, etc.) were averted because of political will based on solid scientific understanding. We cannot count on complete scientific understanding when it comes to positive feedback loops and climate change.

## Adv – innovation

### AT biotech not key

#### Biotech k2 growth—innovation impact’s every sector of the economy

National Intelligence Council’s Strategic Futures Group 2021, "Office of the Director of National Intelligence," No Publication, https://www.dni.gov/index.php/gt2040-home/gt2040-deeper-looks/future-of-biotech//AL

Many forecasts during the past 30 years have anticipated amazing advances in biotech—including cures for disease, eradication of hunger, and the means to transition away from petrochemical dependence—but the story of biotech has been one of incremental gains in food and material production, and medical advances. During the next 20 years, however, biotech is likely to transform a broader range of human experiences. A more multidisciplinary, digital, and data-rich approach to life sciences is accelerating the understanding of and ability to predictably manipulate living matter, although market, regulatory, and normative conditions will moderate the pace and focus of progress. Biotechnology probably will improve many aspects of human existence; however, the pursuit and possible application of these technologies may also create social and economic disruptions and raise numerous ethical questions. BIOSCIENCE POISED TO ACCELERATE Over centuries, our use and manipulation of life processes in agriculture, medicine, and manufacturing have progressed incrementally, punctuated by leaps in understanding brought about by key discoveries, such as Mendelian genetics, Germ Theory, and DNA. These leaps could not have happened without the development and acceptance of novel tools and algorithms for detecting, imaging, and manipulating biological systems. During the next 20 years, a more multidisciplinary and data-intensive approach to life sciences will shift our understanding of and ability to manipulate living matter. Scientists are increasingly treating genetic instructions as a form of computational code and incorporating insights and new tools from the rapidly advancing realm of computational science. These disciplines, combined with cognitive science, nanotechnology, physics, and others, are propelling new leaps in our understanding. It is anticipated that the collective application of these diverse technologies to the life sciences—known as bioconvergence—will accelerate discovery and predictability in biotech design and production. This multidisciplinary approach has made it possible to: Visualize, measure, identify, and manipulate biological systems at molecular scales Treat genetic instructions in DNA, RNA, and amino acids like a language that can be written, edited, and executed with high precision to synthesize useful materials or organisms Collect, digitize, store, and analyze genetic instructions, referred to as genomes, from many thousands of individuals, along with their physical, mental, and health traits to correlate how specific genetic instructions interact with the environment to produce distinct traits Combine complex biological and nonbiological processes, such as bioelectronic interfaces for sensing or stimulating biological systems in support of medicine, agriculture, and manufacturing FACTORS SHAPING BIOTECH’S TRAJECTORY Economic, social, and political factors are likely to influence the pace and focus of biotech research and the availability of products. Increased Investment and Decreasing Cost These economic factors together will be pivotal to future biotech breakthroughs and applications. In 2019, the global bioeconomy, defined as all activity enabled by research and innovation in the life sciences and biotechnology, accounted for about $5 trillion, or nearly 6 percent of global GDP. Based on 10-15 percent annual revenue growth trends, the world bioeconomy could exceed $20 trillion by 2030. A drop in the cost of key enabling technologies could spur application of biotech to a wider set of challenges and potentially democratize aspects of biotech R&D and production, increasing its global accessibility.

#### Biotech sector is a major pillar of future growth

Rebecca Cons 22, 5-9-2022, "Solvay declares biotech a key pillar of future growth : Biofuels Digest," No Publication, https://www.biofuelsdigest.com/bdigest/2022/05/09/solvay-declares-biotech-a-key-pillar-of-future-growth//AL

In Brussels, major chemical maker Solvay has declared renewable materials and biotechnology a major pillar of future growth. The company, which reported $10.6 billion in sales last year and is among Europe’s largest chemical producers, says the platform will build on its already leading position in biobased products that includes guar, solvents, and vanillin. Its other growth platforms are battery materials, green hydrogen, and thermoplastic composites. “The sustainable use of renewable resources and biotechnology has gained momentum in the industry and has the potential to help solve some of the most pressing challenges faced by society today,” Solvay CEO Ilham Kadri says in a press statement. “Through our new growth platform, we aim to connect with our partners to reinvent progress, as we have done throughout our 160-year history, playing a key role in the chemical industry’s transition to the bioeconomy and helping to create the sustainable and circular solutions required by society.” Solvay says it will pursue products with applications in agrochemicals, personal care, food and flavors, and advanced materials for transportation and aerospace. The company expects products made using synthetic biology to account for a third of global manufacturing by the end of 2030.

### add on -- Democracy !

#### Diplomatic credibility is key to democracy

Burns 20, Goodman Family professor of the practice of diplomacy and international relations, is chair of the Harvard Kennedy School’s Program on Transatlantic Relations, director of the Future of Diplomacy Project, and a co-leader of the American Secretaries of State Project (Nicholas, “The Indispensable Power,” *Harvard Magazine*, <https://www.harvardmagazine.com/2020/07/features-forum-indispensable-power)//BB>

MY EXPERIENCE in government has also taught me that diplomacy is most effective when it is cemented in American values and the rule of law. That should lead us to stand up for democracy when it is threatened in NATO-allied countries such as Turkey and Hungary, and when human rights are assaulted in Russia and China. When I interviewed former Secretary of Defense Jim Mattis a few months ago in Washington, he pointed to this foundational American strength. The United States exercises two great powers in the world, he said. The first is the “power of intimidation,” through our first-class military. But America has a second and more important power—the “power of inspiration” to the rest of the world, reflecting our nation’s democratic founding. A Harvard audience heard a variation of this theme from Winston Churchill in Memorial Hall on September 6, 1943, when he received an honorary doctorate of laws from President James B. Conant. In a lyrical speech entitled, “The Gift of a Common Tongue,” Churchill urged his audience of deans, professors, and dignitaries—and in later remarks in nearby Tercentenary Theatre, more than 6,000 cadets training to go to war—to reject isolationism and accept the mantle of world leadership. At a time when the United States had surpassed the British empire as the most powerful global leader, Churchill’s speech was a metaphorical handing of a baton to the young Americans on the front lines of World War II. “The price of greatness is responsibility,” he said. “One cannot rise to be in many ways the leading community in the civilized world without being involved in its problems, without being convulsed by its agonies and inspired by its causes.” Churchill’s words at Harvard then are as vital and relevant to Americans today. Americans can author a better, more just, and peaceful era if we recall our responsibility to lead and to be a force, through diplomacy, for democratic values in an ever more complex and dangerous world.

#### Democracy solves a laundry list of impacts---economic growth, public goods, alliances, and war---the US is key.

Lee ’18 (Carrie; is an assistant professor at the U.S. Air War College and a Security Fellow with Truman National Security Project. Any views expressed are those of the author and do not reflect the official policy or position of the U.S. government, the Department of Defense, Air University, or Truman National Security Project; *The Truman Project*; September 10th; “Why Democracy Promotion is in the Strategic Interest of the United States”; [https://medium.com/truman-doctrine-blog/why-democracy-promotion-is-in-the-strategic-interest-of-the-united-states-ae959c111b2f](about:blank); accessed 7/9/19; MSCOTT)

However, reducing the United States’ emphasis on a values-driven foreign policy is wrong, and contrary to the strategic interests of the United States. Democracy promotion in particular serves a key role in safeguarding U.S. interests and promoting global, long-term growth in ways fundamentally compatible with U.S. strategic interests. After all, democracies protect private property in important ways, invest in public goods, are more politically stable, make for more dependable allies, and empirically do not go to war with one another. Ultimately, a world full of democratic governments is safer, more prosperous, and more stable — all states of being that the United States has an interest in promoting.

Democracy guarantees that the public has a stake in its own institutions and government, which leads to investor confidence and growth. Since elected politicians are accountable to property owners and are held in check by an independent judiciary, democracies tend to have better mechanisms for protecting private property than their autocratic counterparts. This makes democracies a particularly attractive type of country for investors — both public and private — because checks and balances make it difficult for the state to nationalize industries. Further, private property rights protected by the legal system encourage entrepreneurship and small business development, both of which are key to a growing and modernizing economy. As a result, democracies tend to be wealthier and more economically stable than their autocratic counterparts. This is fundamentally in the interest of the United States in that both private and public investors have an interest in seeing returns on their investments, thereby potentially making countries less willing to go to war if that would require severing economic ties. Democratic institutions ensure that citizens with both economic and political power are heard.

Democracies also invest in public goods at much higher rates than autocratic governments. Because politicians must cater to the median voter, they approve policies that invest in public education and healthcare, both of which promote long-term growth and development. Public education invests in a country’s human capital, setting the stage for long-term innovation, adaptability, and advancement. Public healthcare, meanwhile, has been shown to increase overall societal productivity and well-being as people take fewer sick days, citizens are able to afford their healthcare without going bankrupt, and ultimately, the overall costs of healthcare are driven down as citizens become healthier. Productive, innovative societies are also better for the United States — innovation around the world improves global quality of life, results in more educational and vocational opportunities for Americans (both because other universities and jobs become more attractive to Americans who want to go abroad and because potential immigrants are more likely to want to stay in their own country, opening up opportunities for U.S. citizens at home), and may reduce friction between countries over resources and labor.

Democracies are also generally more politically stable because regular election cycles ensure an established process for the habitual and peaceful removal of leaders from power. Elections ensure the non-violent transition of power and reduce the need for mass protest, rioting, and revolution — which makes countries more politically stable. Further, when citizens are granted rights and protections from government abuse, enforced by an independent judiciary, they have fewer grievances against the government and are thus less able to mobilize large numbers of people to violently overthrow the regime. Revolution, while not always violent, often leads to political instability, challenges to growth, increased incentives for diversionary war and conflict, and oftentimes civil war. The externalities of civil war and international conflict then put pressure on the United States to intervene, protect human rights, and otherwise expend resources on other countries’ issues. Further, civil wars are highly destructive to institutions, human capital, and resources, and can have significant security spillover effects, increasing global risk of political instability and violent extremism.

This political stability, in addition to institutional checks and balances, makes democracies better international partners and allies in the long-term. Treaties ratified by multiple branches of government are more durable than executive agreements signed by a single leader who may be replaced within a short period of time. While democracies may be more reluctant to commit to alliances and formal security pacts, once a party to them, they are more dependable than other states with concentrated power at the executive level. These kind of durable commitments are of interest to the United States as it seeks to preserve the liberal world order; it is far more effective to ally with partners whose institutions make withdrawal from the alliance costly.

Finally, it has been empirically observed that democracies do not go to war with one another. While there is a robust debate around the exact nature of the so-called “democratic peace,” it appears that there are qualities particular to democracies that make war between them particularly unlikely: a dovish public constrains leaders’ ability to wage war, competitive elections and a free press make it easier to credibly communicate resolve to potential adversaries, consolidated democracies tend to be more wealthy and economically interdependent, like-minded people are more hesitant to wage war against one another, and so on. Regardless of the precise mechanisms, however, a world of democracies is inherently safer, more prosperous, and less likely to initiate a war against the United States — a key factor in protecting American security and interests.

## Adv-- Leadership

### AT no biotech development

#### **Yes biotech development**

Rob Carlson 21 - PhD, managing director at Bioeconomy Capital & affiliate professor in the Paul G Allen School of Computer Science & Engineering at the University of Washington "Beyond Biological Defense: Maintaining the U.S. Biotechnology Advantage," War on the Rocks, https://warontherocks.com/2021/09/beyond//AL

The global growth of the sector is likely to accelerate demand for the pro ducts of biotech. New tools, decreasing costs and an expanding skill base imply that more people in more places will have access to more powerful technology (4,30,31). Governments around the globe are grappling with the desire to benefit from biotech-driven economic development, while simultaneously facing questions about who should have access to which technology and under what circumstances. The US government has taken an official position that physical and economic security, in addition to economic and employment growth, are best served by encouraging and embracing open access and innovation in biotech in all contexts, "from cutting-edge academic institutes, to industrial research centers, to private laboratories in basements and garages" (32). This position sets the stage for a necessary refocusing of biosecurity discussions and practices. Relying on biotech to produce economic growth requires support both for research and job creation and for safe and secure use in equal measure. These goals are hampered at present by the lack of data and reporting on biotech as an industry. Addressing these deficiencies in measurement is a necessary first step in accurately quantifying the role of biotech in the economy. The voluntary ignorance resulting from the absence of such data confounds an understanding of national security that surely must include the economic role of biotech in the context of both biological production and natural resources. Consequently, it is important to better discern the impact of underlying technological development on physical and economic security and on the economy as a whole. Biosecurity has typically been interpreted as the physical security of individuals, institutions and the food supply in the context of threats such as toxins and pathogens. These will, of course, continue to be important concerns. Yet governments can no longer limit their concern to the proverbial white powder produced in a state-sponsored lab, a 'cave' in Afghanistan or a garage in Seattle (33). Safeguarding the large and rapidly growing bioeconomy requires embracing a more substantial challenge; it is essential to have a refined and ongoing understanding of what must be secured and from where threats might arise. Economic demand is driving technological proliferation, and the revenue estimates described here must necessarily inform the evolving definition of biosecurity. Alongside the preexisting bioeconomy, we are building a system composed of inherently 'dual-use' engineering technologies that will constitute critical infrastructure for the future economy. Assuming that the revenue and growth estimates above are borne out with improved measurement and analysis, biosecurity is now clearly synonymous with economic security. The focus of biosecurity policy must shift from protecting specific targets from specific threats to securing the bioeconomy as a system that increasingly drives economic growth and employment and, ultimately, enables humans to thrive on a global scale.

### AT No China rise in biotech

#### US currently leading in biotech innovation but China rise on the horizon

Rob Carlson 21 - PhD, managing director at Bioeconomy Capital & affiliate professor in the Paul G Allen School of Computer Science & Engineering at the University of Washington "Beyond Biological Defense: Maintaining the U.S. Biotechnology Advantage," War on the Rocks, https://warontherocks.com/2021/09/beyond//AL

Maintaining America’s Biotechnology Advantage Biotechnology in the United States is a significant contributor to the economy. By one estimate, in 2017, U.S. biotechnology revenues exceeded $400 billion, or 2 percent of gross domestic product, substantially surpassing better-measured sectors such as mining. Bioeconomy revenues have grown at an average rate of 10 percent annually for two decades. Notably, U.S. biotechnology revenues alone were approximately equal to worldwide semiconductor revenues for 2017. Biotechnology now supplies critical medicines, and, as more than 90 percent of the corn and soy grown in the United States is genetically modified, biotechnology feeds the armed forces. Industrial biotechnology is responsible for upward of 20 percent of chemicals produced in the United States, suggesting a similar proportion of chemicals used in the military are also biologically derived. And these impressive figures may still be significant underestimates: Using a different methodology, the U.S. National Academy of Sciences recently concluded that the biotechnology industry contributes 5 to 7 percent of U.S. gross domestic product. Biotechnology, therefore, may already constitute an even larger share of the military supply chain. As biotechnology continues to mature, its contribution to physical and economic security will become even more significant. Tools are now being deployed that enable the engineering and biomanufacturing of materials that will eventually not only displace petrochemicals but also surpass them in production scale and performance. Over the next ten to twenty years, biological production could soon supply up to 60 percent of physical inputs across the global economy, and biotechnology could have a “direct economic impact of up to $4 trillion a year.” While the United States is arguably still leading in biotechnology, it risks losing this lead to China. In China, biotechnology is a national development and a security matter. China’s Innovation Driven Development Strategy emphasizes biotechnology’s essential role in the country’s economic development, while the Military-Civil Fusion Development Strategy seeks to ensure that biotechnology research is also oriented toward the country’s military and broader security goals. Chinese biotechnology revenues are reported to be of a similar size to those in the United States, although they are subject to even lesser clarity in reporting. While China continues its licit and illicit acquisition efforts targeting the U.S. biotechnology sector, it is also shifting its attention to domestic innovation. In time, this will provide the People’s Liberation Army with new capabilities and increase both America’s and the Pentagon’s reliance on Chinese biotechnology products.

## Solvency

### SPD -- NATO-US Bioethical Network guide

#### The plan utilizes soft power diplomacy tools and methodologies to create architecture for a NATO-US Bioethical Network to guide national security policymakers

Venkat Rao and Cassandra Waite, 12. “Soft Regulatory Mechanisms and Open-source Bioethics to Counter Biothreat Proliferation.” Rao is a chief scientist at ERP international and Doctor of Philosophy. Waite Applied Biosafety 17 (2012): 110 – 119//AL

A Broader Context for Soft Power Diplomacy (SPD) One of the more common examples used to describe the demonstrable effectiveness of SPD is its application in global communication via broadcasting media. For example, in the aftermath of World Wars II, when the Cold War had just begun between the U.S. and the Soviet Union, Radio Free Europe and Radio Liberty were created by the United States and the British Broadcasting Corporation (BBC) as conduits to provide more accurate world news to listeners all over the world, particularly to the audience in Eastern Europe, South East Asia, East Asia, Africa, and Latin America. Cultural centers were created all over the world as another conduit to communicate the merits of democracy and a free market society to the common man. A long-term objective was to use these communicated merits to generate admiration and respect for the West. It is interesting to note that SPD tools related to communication were instituted as public diplomacy to alter the behavior of foreign powers by influencing its citizens. The basic asArticles Downloaded by 67.194.0.233 from www.liebertpub.com at 06/24/22. For personal use only. 112 www.absa.org Applied Biosafety Vol. 17, No. 3, 2012 sumption was that if public opinion in a nation or region is molded towards objectives favorable to the West, this would create internal pressure for the hostile foreign government to alter its behavior towards its rivals and ideologies. Many decades of investment in global broadcasting programs during the Cold War yielded desirable results, measured by the fact that more nations in the world have elected governments and open economies, and espouse free trade than ever before. Modern communication technologies—particularly the interactive forms of social networking and the Worldwide Web—have introduced radically new mechanisms to communicate and share information, which are likely to play a major role as soft powers (Nye, 1990). The participation of non-state actors, such as the non-governmental organizations (NGOs), transnational corporations (TNCs), and transnational media corporations (TMCs), has further empowered SPD tools in global communication through social networking media. Tehranian (1997) reported that there are over 30,000 NGOs compared to 200 state actors, but if the number of TNCs and TMCs is taken into account, a significant level of complexity and role-play for SPD in international relations has been added. The scientific community has embraced the latest technological innovations in communications and information sharing with the utmost enthusiasm. This is evidenced by a growing number of online versions of peer-review journals, web sites, and portals exclusively devoted to new biology and life sciences research; here, a vast global network of scientists and technical experts can share information on their current research interests, findings, and guidelines for others to experiment and validate. The open forum used by the scientific community fosters transparency, promotes information-sharing, and propels innovation in research and development. Simultaneously, this environment poses serious security issues on what are generally known as DURC. No regulatory mandates oversee and monitor the vast online media currently used by the scientific community, and it is safe to assume that mandated regulations are less likely to modulate individual scientists regarding ethical questions related to DURC and its potential impact on the research institutional safety and national security. Within this context is where employment of SPD options might prove more effective in modulating behavior through voluntary means. There are good examples, albeit from other industry sectors, where use of SPD options has yielded desirable outcomes. Public diplomacy related to national and international policy on environmental protection and promotion of equity in labor laws and workman compensations has yielded Figure 1 National security policymakers and the scientific community face overlapping bioethical issues during operational planning and implementation of biosecurity and bioterrorism preparedness programs. positive outcomes of global significance. For instance, in global labor governance—in the absence of a formal legal framework—self-regulation, norm setting, and international labor codes provided a policy premise attractively referred to as “voluntaristic initiatives” (Hassel, 2008). Remarkably, the SPD measures to rectify global labor governance did not stem from national governments or from multilateral forums such as the United Nations or the World Trade Organization. Instead, the public diplomacy channeled through mass media and social networking created broader global awareness on issues related to workplace safety and compensation. As a result of increased global public awareness and response by way of consumer boycotts, the private sector adopted more progressive workman compensation programs and invested in improving the quality of workplace conditions, for they could not afford to ignore the collective voice of their consumers (Hassel, 2008). As a result, we now witness a vast number of large, multinational corporations embracing good labor practices and even publicizing these efforts in the marketing of their products. Companies now tout their safe workplace environment, good wages, and best labor practices as part of a corporate culture because it is popular now to be socially responsible. While one could argue that some sectors within the industry have adopted ethical practices because it is the right thing to do, a compelling argument could be made that it makes a better business case offering or a better economic incentive, or arguably that it is a necessity for companies to meet or exceed the ethical demands of consumers and their special interest groups. SPD in this case could be interpreted as the collective voice of consumers that now has a huge influence on the global marketplace and the international economy. A broader global acceptance of an environmentally friendly “green policy” is yet another example where SPD measures have made a significant impact on environmental diplomacy when environmental treaty-making systems were deemed less effective (Susskind, 1994). SPD in environmental diplomacy offered self-enforcing options to nationstates without compromising their sovereignty and promoted better coordination among the various institutions involved. NGOs working on environment and global ecosystem protection promoted SPD tools and measures as part of global agreements aimed at environmental sustainability, greater awareness of pollution, and the need for environmental protection. Progress was made possible in this arena by carefully crafted SPD tools and methodologies that were deployed to influence government policymakers and regulators, private and public sectors, academia, and the international media. Soft Power Diplomacy to Counter Biological Threats It is evident from the preceding section that SPD tools and methodologies have remarkable success in the formulation and implementation of national and international policies related to public health, trade and commerce, and protection of the environment and ecosystem. Human pursuits to understand natural processes through research and discovery are essential aspects of our society, and therefore, SPD tools imparting education and training for aspiring scientists to increase awareness on the dual-use threats and instill code of conduct for responsible behavior may succeed as well. Existing biological threat-related mandates are mostly hard regulations promulgated either at the national level or a binding requirement under the existing international biological arms control regime. However, during the past 2 decades, policymakers, life sciences researchers, and the biotechnology industrial community have evidenced interest in exploring SPD tools and methodologies in what could be the architecture for future biological engagements covering research and development, global health security, and protection against new and emerging diseases and threats of bioterrorism. Unfortunately, progress in bioengagement architecture remains fragmented due to a divergent stakeholder community and an overall lack of understanding of the potentials of misuse of new frontiers in modern biological research and development. Bioethics-based SPD provides the enduring quality of higher-order thinking and enhancement of quality of life through self-imposed behavior modification, which is inherently appealing to the research and policy communities. Understanding the moral dimensions of the emerging health and biological systems, and analyzing them according to the bioethical principles and core value system of the community, will drive decision making at the bottom levels, where the practice of science and medicine occurs. SPD will provide the conceptual framework to evaluate a series of competing options and illuminate the inherent recognition that there is no single moral course of action. Practical application of a bioethics-inspired SPD framework faces fundamental challenges.

First, policy analysts and researchers working on SPD in the international arena often cite the sheer complexity of the legal and technical issues involved in domains such as global nonproliferation treaties, international labor laws, and environmental protections that render hard regulations less effective in the long run (Sisson & Marginson, 2001). This would apply to any treaty-based efforts towards nonproliferation of biological weapons given the sheer size, scope, and complexity of modern biological research and the vast and varied applications in the biotechnology domain. For instance, the 1972 BWC has no provision for enforcement because of the fundamental difficulties with verifiability of treaty compliance. A key problem with the implementation of verification is that the BWC applies not only to sovereign entities but also to private parties as well. Unlike nuclear nonproliferation treaties (and the AntiBallistic Missile Treaty [ABM] which involves sovereign nations’ commitment to reduction and eventual elimination through mutually verifiable and implementable protocols), biological treaty verification covers an extremely vast array of stakeholders involving the private sector, university research laboratories, and contract research facilities in biotechnology R&D and commercial development. A formal inspection regime is bound to be ineffective, and compliance verification is nearly impossible. Second, bioethics-based SPD approaches are likely to be more effective in the globalized biotechnology research and commercial environment, where business-to-business contacts and networked strategic communication have assumed a prominent role in engaging the stakeholder communities. SPD tools and methodologies are better suited to exploit the evolving social networking and other platforms for communication and information-sharing such as professional societies, disease surveillance and reporting networks, data sharing and reporting systems, and collaborative research programs. SPD tools will greatly benefit the global biotechnology research community and the industry that depends on new biologics-based product development and commercialization. Likewise, global informationsharing on disease prevention and health promotion through the 2005 World Health Organization’s International Health Regulations (IHR) (WHO, 2005) brings the global comity of 194 nations as state parties to voluntarily share diseasespecific information through a standard reporting format. The goal to harmonize global rules to categories of infectious disease identification and reporting has inherent appeal as a SPD, where the broader aims are to enhance national, regional, and global public health security. Finally, bioethics-inspired SPD tools offer more flexible approaches to addressing thorny issues, such as conflicts of interest among stakeholders involved in various aspects of public- and private-funded biotechnology ventures, compared to mandated compliance with national regulations or treaty obligatory requirements. This is basically due to the fundamental differences in the enforcement between SPD and mandatory regulations. Whereas, successful implementation of a mandate is primarily via some form of legal sanction or a form of punishment, SPD methodologies carry no such punishments due to noncompliance. Instead, SPD approaches are primarily driven by ethical and moral implications of advances in biomedical sciences and on value judgments pertaining to code of conduct and responsible behavior in the areas of biological research and biotechnology. SPD tools such as peer-review audits, institutional review boards, best business practices, and institution collaboration are premised on professional responsibility and practitioners’ voluntary commitment to adhere to institutional-level oversight and the broader ethical and moral questions related to science, medicine, health, life, and the environment. Education and Training as SPD Training and educational programs in bioethics and biosecurity as part of university curricula towards advanced degrees in modern biology and biomedical sciences would considerably promote aspiring scientists’ awareness of dualuse threats and recognition of biorisks in their own work and in that of others. Unfortunately, in current university curricula for students, few educational modules exist regarding ethics training on biological and biomedical tracks, and even those few programs treat biosecurity and dual-use issues only superficially. A case-study of bioethics training in the United Kingdom reported that biosecurity-related education received scarce attention from educators, and bioethics course modules reviewed during the study did not adequately address biosecurity and dual-use issues (Revill, 2009). To a large measure, training in bioethics would serve as the lynchpin in educational programs, bringing up the moral obligations and expectations of responsible behavior on the part of the scientific community regarding the potential security implications of dual-use research (Kuhlau et al., 2008; Selfelid, 2009). Institutions such as Bradford University (Bradford, England) with leading-edge educational programs in bioethics and biosecurity have focused on educational criteria to identify biorisks and obligatory measures on the part of life scientists to take preventive measures. The SPD-based moral obligations offer training modules to: a) prevent bioterrorism; b) engage in responsible activities; c) recognize negative implications of dualuse research; d) avoid submitting for publication study results posing biosecurity risks; e) participate in educational and training programs promoting biorisk awareness and dual-use risks; f) maintain oversight of dangerous pathogens and toxic substances in the laboratory; and g) develop a protocol to deal with suspicious activities of students and laboratory staff. Training modules addressing these core criteria should be available more broadly, both as part of formal educational programs and on-the-job training programs for staff and laboratory operators. Recognizing the value of dual-use education for scientists, the BTWC Review Conferences have repeatedly identified education, awareness-raising, and ethics training on code of conduct and responsible behavior to prevent potential misuse of biological research (BTWC, 2008). However, no clear guidelines are available to state parties on the nature of educational and training programs, implementation metrics, and performance measures. Given the vast scope and scale of the modern global biological research enterprise, educational programs for national implementation ought to address a much broader range of activities if the goal is to prevent misuse of research and prevent acquisition and use of biological weapons. This is yet another justification to more actively consider SPD-based tools to impart broader awareness through bioethics and biosecurity education and training programs. Moving Toward a Global Bioethics Network The conceptual architecture guiding bioethics-inspired SPD will resonate with a) the medical ethics first written in the 18th century by Thomas Percival, which forms the code of ethics in the practice of clinical medicine and the ethical framework in the 1846 creation of the American Medical Association, and b) the Nuremberg Code for research ethics, established in the aftermath of World War II, on the use of human subjects in experimental research (Mitscherlich & Mielke, 1947). In 1979, the U.S. Department of Health and Human Services issued the first historical document on ethical principles and guidelines for the protection of human subjects. This was known as “The Belmont Report” and provided a set of bioethics-inspired principles of respect, beneficence, and justice as the foundation for use of human subjects in medical research (DHHS, 1979). Most recently, the 2009 Presidential Commission for the Study of Bioethical Issues for the first time addressed more broadly the bioethical issues related to advances in biomedical sciences research and biotechnology and explored SPD options to ensure the freedom to pursue scientific research and innovative technology development in a socially and ethically responsible manner (DHHS, 2012). These guidelines offer a conceptually cohesive framework to the more challenging task of crafting SPD approaches taking into account the difficult bioethical issues surrounding the spectacular progress in biomedical and genomic research. It is relevant to note that the conceptual elements of SPD and regulatory mandates and treaty obligations have interdependencies, and the overall effectiveness of the former is linked to the policy-guiding development and implementation of the latter. Figure 2 illustrates the interdependency of SPD with the policy-making and regulatory establishment and implementation process. Mandatory regulations by design require compulsory compliance and stipulate penalties for noncompliance. Hence, success in a large measure depends on faithful compliance by the regulated community, which is where SPD tools and methods come into play. Defined more broadly as a process that effects a change in attitude upon a willing subject without invoking the regulatory mandates, SPD aims to enhance voluntary stakeholder participation towards the broader regulatory objectives set forth under the mandates. Simultaneously, SPD tools and methodologies offer the regulatory community feedback on the mandates to allow further modifications in the regulatory process to improve implementation effectiveness and to better coordinate with the regulated community. Therefore, maintaining internal consistency with mandatory regulation is a crucial aspect in the formulation of SPD strategies. We propose bioethically-inspired SPD tools and methodologies be closely linked to the existing regulatory process to ensure consistency in communication and to assess overall compliance. Key criteria would involve identification and delineation of the essential conceptual elements of SPD architecture. The decision-making process in a clinical or laboratory setting among two or more seemingly conflicting choices often revolves around anticipated positive or negative outcomes at different levels: Articles Figure 2 Bioethical principles guide formulation and interpretation of soft power diplomacy initiatives and its interdependency with hard regulatory mechanisms. Downloaded by 67.194.0.233 from www.liebertpub.com at 06/24/22. For personal use only. 116 www.absa.org Applied Biosafety Vol. 17, No. 3, 2012 a) The first set of decision points revolves around individual needs and interests weighted against those of the community, where choices may present options beneficial to one while placing a serious burden on the other. b) The second set of decision points revolves around short- and long-term benefits, where options offering immediate short-term benefits require careful consideration of long-term impact on human society and the general environment. c) The third and final set of decision points revolves around the balanced consideration of administering justice as opposed to the relevance of mercy to the affected community. For example, the decision to provide licensure for a new category of medical countermeasures may address a serious public health problem but at the same time pose an unquantified measure of risk to population subgroups likely to be exposed to the new medical countermeasures. Bioethics-inspired SPD should recognize the basic dilemma presented in each of these decision points where competing values are at play. Therefore, the need for a SPDguided decision-making process would extend beyond the professional communities and their governing institutions. The bioethics-inspired SPD roadmap would have to engage a broader participation of society-at-large since the overall impact is on the human society as a whole. A global bioethical network of broader stakeholder communities will be actively involved in the formulation of SPD tools and methodologies that go beyond the narrow confines of regulatory mandates. Figure 3 illustrates the functional components of bioethics-inspired SPD tools and methodologies, where considerable emphasis is placed at the individual and institutional level and provides transparency to a wide array of stakeholder communities throughout the network. Nodal elements participating in the network would participate in dialogue and discussions ranging from: a) initiatives to modify behavior at the individual level that results in self-governance; b) balanced consideration on threats to populations versus individuals as in the case of bioterrorism; c) methods to safeguard DURC and intellectual properties produced through research; and d) approaches to improve biosecurity without hindering the advancement of biomedical science research and technology innovations. As illustrated in Figure 3, the proposed SRM tools and methodologies of a global bioethical network are directed primarily at individual scientists and the institutional-level decision makers with a guiding rationale that better outcomes are realizable when implemented proactively as a voluntary initiative to broadly promote education, awareness and active participation: • Peer-review (for both ethics and safety) of research proposals to ensure that proposed research is fully vetted prior to initiation of the project. Articles are already being reviewed by most of the popular publications to ensure that gained knowledge is not publicly available if it should be determined a threat to biosecurity (Johnson, 2012). Articles Figure 3 Soft power diplomacy tools and methodologies constituting the conceptual architecture for a Global Bioethical Network guide national security policymakers and the stakeholders in the scientific community. • Research checklists to aid scientists in determining if their research takes into account all the concerns of biosecurity and also to help ingrain the standards through repetitious use of the tool. • Dual-use plan for publicly funded projects in the future (e.g., animal use plan). Currently, biosafety plans are required when submitting grant proposals, but it should become a standard practice for government-funded research to also require a plan to ensure the protection of dual-use information through a “dual-use plan.” • Clearinghouse for scientists to direct questions and to determine if a piece of information or specific research area is a biosecurity concern. • Advisory boards at the state level similar to the U.S. National Science Advisory Board for Biosecurity (DHHS, 2012) with the aim to better utilize local and regional capabilities for oversight and to promote educational awareness. • Research assessment template for individual assessment of potential research. • Global forums and NGOs can serve as venues for best practices and experiences to be shared. We should focus on creating communities at this level and down to the individual. • A list of proposed obligations for life scientists as a set of standard, widely accepted, best practices from peers across the field. • Training on best practices. As illustrated in Figure 3, performance outcome depends on proactive initiatives at the individual level and voluntary participation of institutions in the overall process. Unlike the established regulatory framework that depends solely on enforcement by authorities at the national and international levels, the SPD framework for the bioethical network is proactive, participatory, and fundamentally based on the awareness of the community. National science policymakers have considered policy options and research standards, and best business practices to oversee DURC without compromise on the essential core tenants of the freedom to pursue biological research (Shea, 2007). These efforts are in concert with concurrent initiatives from the scientific community (NRC, 2004). However, the framework outlined in this study formally integrates a systems approach to the evolving consensus in the scientific community towards simultaneous measures that promote self-regulation at the individual level and better biosecurity measures at the institutional level, both supported by increased biodefense-related awareness and educational programs (Dolgister, 2007). The global bioethical network would serve as the SPD architecture to develop in a proactive manner in tandem with major international forums, such as the Intersessional Working Groups of the BWC and the World Health Organization, aimed at broadening the network of communities and providing a forum to develop and test novel SPD tools. These tools are aimed at improved awareness of biological risks and a better understanding of the threats posed by new and emerging infectious diseases. The network would provide a forum for sustained interactions among various participants and a cross-cultural dialogue on the development of national systems for research ethics, education, and outreach. Recommendations National security policymakers examining alternate options to meet the goals of biological threat reduction through treaties and hard regulations ought to place more emphasis on the potential role of SPD tools and methodologies for developing universal norms towards open-source bioethics. Policymakers should note the effective precedence in the contemporary international arena to articulating SPD approaches as alternative options to meet the goals and objectives of the treaty- and legislation-based hard regulations. • Leverage growing awareness: National security policymakers should consider SPD-based policy alternatives to more effectively leverage the growing awareness among scientific researchers towards self-regulation and the promotion of responsible conduct in research. Institutionlevel guidelines on research misconduct, safe handling of sensitive data and materials, and a peer-review process in research publications that takes biosecurity into account are also required. Clearly, regulatory mandates and international treaties are partial solutions to addressing the sensitive and contentious bioethcial challenges associated with biological threat reduction and biosecurity. • Alternative options to empower regulatory mandates: A bioethics-inspired SPD framework has the power to dramatically alter the nature of discussions related to biosecurity in the life sciences research enterprise. In particular, the dynamic of the SPD framework should address the shortcomings in existing regulatory mandates in the biotechnology-driven Bioeconomy, where not much is known of its inherent hazards and potential long-term impact on human society, the general environment, and national/international security. • Engage the global community on the merits of SPD initiatives: Bioethics-inspired SPD is attractive for its enduring quality of high-order thinking that shapes quality-oflife goals. A deliberate process aimed at embracing the moral dimensions of human endeavors, such as in conducting research with troubling ethical dimensions, with the potential to adversely impact health and the general environment, will guide decision making at the operational level. • Integrate bioethics-based SPD as part of education curricula: Given the broad interdisciplinary nature of the SPD tools and methodologies, universities and institutions should develop educational and specialized training programs catering to students pursuing careers in science and technology, law, public policy, and business. These training programs should focus on the nonbinding rules or instruments in the SPD and approaches to integrate these tools within the existing regulatory framework. Biosafety professionals have stressed the value of well structured educational programs on codes of conduct, biosafety, and biosecurity as a prerequisite for graduation in advanced university education and training programs (Johnson, 2006). Bioethics-inspired SPD tools and methodologies could also play a meaningful role in biological arms control and biological threat reduction goals. They could aid in carefully evaluating and deciding among a series of competing options, but with the inherent recognition that there is no single moral course of action. Active participation from the scientific and policy communities is essential to further articulate the influential role of SPD in countering biothreat proliferation and to gain participation of other stakeholders

#### Only soft regulations are key to solve – any alternative means NATO say’s no and private organizations circumvent

NATO say yes—plan popular

Venkat Rao and Cassandra Waite, 12. “Soft Regulatory Mechanisms and Open-source Bioethics to Counter Biothreat Proliferation.” Rao is a chief scientist at ERP international and Doctor of Philosophy. Waite Applied Biosafety 17 (2012): 110 – 119//AL

Introduction Much of the current focus in biodefense, aimed at countering current and emerging biological threats, has been interdisciplinary in scope, drawn mostly from the foundational ethical guidelines for medicine, science, public health, law, the environment, war, and international relations. As a result, biodefense and counter-bioterrorism programs at national and international levels have sought to employ conventional regulatory frameworks by merging a collection of concepts and guidelines implemented as “hard regulations,” but without systematically addressing the unique challenges posed by biodefense and biological threats. Technical and policy experts concur that hard regulations are likely to be counterproductive in the long run, when the academic research and private enterprise business models thrive on the basic principle of freedom to pursue scientific research and free exchange of information among the community of researchers and biotechnology business entrepreneurs (Roland, 2007). Public policymakers in government and multilateral agencies faced with challenging tasks involving environmental protection, national security, economic policy, healthcare, and labor laws are beginning to explore a range of options that include command-and-control type regulations and others involving participatory instruments and working with stakeholders to change behavior (Gaudioso & Salerno, 2004; Gunningham & Sinclair, 1998). For example, comparative risk assessment is increasingly used as a decision-making tool in the environmental and public health policy decision-making process involving the scientific community, public policymakers, and public stakeholder communities (Alm & Rao, 1994). The U.S. National Research Council employed a biological risk assessment paradigm to assess the operational safety of advanced emerging pathogen disease research laboratories (NRC, 2010a), or the maximum credibility event-based environmental consequence analysis to assess safety of high biocontainment laboratories (NRC, 2010b). From a public policy standpoint, some experts and professional organizations have suggested the use of the public health model proposed by Buchanan (2000), where individual interests are subordinated to the interests of the common good of society as the guiding framework for what might constitute a “soft regulation” to biodefense bioethics and a basis for countering biological proliferation threats. Guzman and Meyer (2011) have proposed a formulation for international soft law on international common law to form the basis for international tribunals towards nonbinding interpretations of binding legal rules. As a result, legal consequences flow from a range of nonbinding international instruments similar to expert committee recommendations and advisories and guidelines developed by regulatory agencies in the domestic setting that do not have enforcement powers or legal consequences due to noncompliance. Legal experts have opined that the quasi-legal characteristic of international soft law will be attractive to state parties engaged in a multilateral forum on a regional or international issue. Application of soft regulations is a well-established mechanism in international diplomacy, such as in regional and global multilateral fora aimed at global health protection (Magnusson, 2007; Sutton, 2009; WHO, 2003), prevention and elimination of chemical and biological weapons of mass destruction (Lee, 2004), labor laws (Borghijs et al., 2003; Kuruvilla & Verma, 2006), environmental protection (Alm & Rao, 1994; Koutalakis et al., 2010), and human rights (Andorno, 2009, 2007; Hillgenberg, 1999). Articles Soft Regulatory Mechanisms and Open-source Bioethics to Counter Biothreat Proliferation Venkat Rao\* and Cassandra Waite CSC Defense Group, Alexandria, Virginia Downloaded by 67.194.0.233 from www.liebertpub.com at 06/24/22. For personal use only. www.absa.org Applied Biosafety Vol. 17, No. 3, 2012 111 Using illustrative examples from these well-established international initiatives, this article outlines the basic framework for a soft regulatory mechanism as part of regional or global efforts to coordinate the pursuit of scientific investigations and to manage biological threat proliferation. At the conclusion of the 2006 Biological Weapons Convention (BWC) meeting. titled “Sixth Review Conference of the State Parties to the Biological Weapons Convention,” held in Geneva, it was concluded that national implementation would remain the biggest challenge during the 2007-2010 Intersessional program, which focused on regional cooperation; biosafety and biosecurity; oversight measures for biological research; and increased awareness, educational measures, and international cooperation in biological science and technology. BWC review conferences implement a quasi-regulatory framework to meet the goal of the treaty, which is to promote the development of the peaceful uses of biological agents and toxins. The confidencebuilding measures outlined in these sessions are supposed to provide practical steps to increase the level of

participation at the national level and of various stakeholders in the biological research and the biotechnology industry communities. Exploring confidence-building measures in the context of the BWC might offer attractive alternatives in the formulation of advisories and guidelines as policies related to ethical, political and social issues have grown in tandem with the spectacular advancement in biological research and biotechnology. Evidently, scientific progress has outpaced science policy formulation, particularly regarding contentious bioethical issues. A growing concern over DURC among scientific researchers and security experts has provided sufficient impetus to explore alternate policies aimed at soft regulatory options (Sutton, 2009). Current mandates or treaty frameworks—be they at the national or international levels—are nowhere closer to addressing the intricacies of the policy challenges posed by advanced biotechnology; therefore, conventional regulatory mechanisms are not part of a long-term solution. Background In one of the first conferences of its kind in Europe, a panel of experts explored the ethical implications of scientific research on bioweapons and prevention of bioterrorism (EC, 2004). More recently, the NATO Advanced Research Workshop (ARW), “Ethics, Morality and the Law: Managing Bioterrorism Threats,” convened an international panel of experts to discuss topics related to biodefense and bioterrorism. This has the potential to have a seminal impact on a wide range of national and regional security programs and science-policy areas covering life sciences research and development, dual-use research, health security, and managing bioterrorism threats (DTRA, 2010). In both events, participating experts were specifically tasked to: a) identify mutually contrasting and overlapping viewpoints on the interdisciplinary areas related to bioethics, life sciences research, jurisprudence, and bioterrorism preparedness and response initiatives; b) create a conceptual framework for extended discussions and interactions among the domain experts and key stakeholders; and c) recommend action plans for a systematic process to begin sustained engagements among key stakeholders at national and international levels. The discussions during the 3-day ARW covered an array of views and positions regarding contemporary bioethics and potential implications on education and awareness, advanced biological research and development, national and regional security, and legal and moral implications when managing bioterrorism response (Magnusson, 2007; Rao, 2010a). A key observation from the ARW deliberations was that better understanding and delineation of the public policy domains is the first point where bioethical issues directly juxtapose national security challenges. Relevant topics for further consideration were improved awareness and education, opportunities towards manpower training and harmonization, as well as the implications of bioethical issues involved in life sciences research and biosecurity (Rao, 2010b). Figure 1 lists topics discussed at the 2010 ARW where bioethics-related issues are likely to overlap with operational challenges associated with the implementation of bioterrorism preparedness and response measures. ARW participants considered these (among other key themes) as the basis for a more detailed review and discussion. Identification of these overlapping domains was a key milestone at the 2010 ARW. The working group considered these topics as the basis for constructing a sustained engagement aimed at improved awareness and education, review of DURC, and further exploration of policy options towards “soft” regulations and harmonization of best practices.

#### This coordinated framework creates a flexible regulative program to create safe policies that give room for innovation

EU fails—ignores data

Val Giddings 22, 3-11-202 Giddings has over three decades of experience in science and regulatory policy relating to biotechnology innovations. His work at ITIF focuses on constraints inhibiting innovations in these areas, and remedies to those constraints. Giddings is also president and CEO of., a consultancy focusing on regulatory compliance, media, and strategic planning for governments, multilateral organizations, and industry. "Prospects for Transatlantic Cooperation in Biotech Policy—A US Perspective," No Publication, https://itif.org/publications/2022/03/11/prospects-transatlantic-cooperation-biotech-policy-us-perspective//AL

Mutual self-interest provides a strong basis for transatlantic cooperation in biotechnology based on shared recognition of its vast potential to provide solutions to some of civilization’s most pressing problems. Thanks to explosive advances in our understanding of the many ways in which promiscuous nature has been manipulating DNA and RNA for the past billion years, it is widely anticipated that the 21st century will belong to biology.1 We are now at the point where our ability to innovate is constrained less by technical capability than by the limits of our imaginations. Multiple laboratories and companies on both sides of the Atlantic (and throughout the world) are pursuing promising applications, and experience confirms progress would be accelerated by cooperative approaches. But there are some considerable challenges, especially in agricultural and industrial contexts. The most important rate-limiting factor in our ability to harness biological innovations to the challenges of feeding the world, sustaining human and environmental health, and addressing climate change, is the burden imposed by ill-considered regulations. Unless this bottleneck can be unblocked, the enormous potential for transatlantic scientific cooperation will not yield the necessary fruits. DIVERGENT REGULATORY PATHS: PRECAUTION VS. OPENNESS TO INNOVATION Existing policies, legislation, and regulations do little or nothing to advance human or environmental safety.2 Born out of understandable caution at the dawn of recombinant DNA technologies, today their most obvious impact is to obstruct and discourage research, development, and deployment of innovative solutions to various challenges.3 This is so despite an abundant record of production and consumption of new biotech products with enviable records of improved safety, superior sustainability, and widespread beneficial economic impacts.4 The benefits are so substantial that a pattern has emerged of farmers breaking the law to acquire and plant improved seeds in countries where governments have lagged in allowing access.5 It is one thing to implement policies and regulations ostensibly designed to ensure safety; it is quite another to ignore vast data and decades of experience around the world to maintain obsolete policies and regulations that add nothing to safety or sustainability, but only impede our ability to use the most innovative, precise, and safest tools to address our gravest challenges.6 In terms of regulatory policy and openness to biological innovations, the width of the Atlantic might be measured better in light years than miles or kilometers. As imperfect as regulations for the products of biotechnology are in North America, they are simply indefensible in Europe.7 The United States decided in 1986, after years of study and consultation, that no new laws were required to ensure the safety of crops and foods improved through biotechnology. This was based on the finding that they present no novel hazards, and foreseeable risks of their development and use fall into categories with which humans have considerable experience from millennia of conventional plant and animal breeding.8 The United States therefore decided to regulate these novel products under existing authorities administered by the Department of Agriculture, the Food and Drug Administration, and Environmental Protection Agency.9 While implementation of this policy, the “Coordinated Framework,” has been far from perfect, it has been sufficiently predictable and science-based to enable an explosion of innovation, new product development, and commercial activity. Consequently, the United States has led the world to the present day wherein crops improved through biotechnology are now the global standard for quality seeds, delivering improved yields, safety, sustainability, and economic productivity around the world, with the lion’s share of benefits accruing on behalf of small farmers in developing countries.10 Europe took a different approach. It is one thing to implement policies and regulations ostensibly designed to ensure safety; it is quite another to ignore vast data and decades of experience around the world to maintain obsolete policies and regulations that add nothing to safety or sustainability. The European Union decided to regulate seeds improved through biotechnology as a novel class governed under new regulations specifically focused on an arbitrary category known as “GMOs” (for “genetically modified organisms”). The conceit was that because they represented gene combinations produced by mechanisms supposedly “not found in nature” (but actually ubiquitous) they must present novel hazards, even though none has ever been identified. These putatively novel hazards, despite the lack of any concrete manifestations, allegedly required dedicated, specific, “precautionary” regulations. The resulting regulatory regime proved so burdensome it led to the general collapse of agricultural biotechnology in Europe, which had played a leading role in its discovery and invention. Permissions for field trials proved almost impossible to obtain, products could not be developed and brought to market, academic labs abandoned the field, and the industry relocated most of its assets and activities to the Americas. And Europe became the world’s largest importer of commodity foods improved through biotechnology, only recently surpassed by China. OPPORTUNITY FOR TRANSATLANTIC COOPERATION Many scientists in the EU (and around the world) knew from the beginning that this was the wrong approach, yet the EU pushed its model internationally, with aggressive diplomacy, leading to emulation by many countries in the developing world, with equally unhappy results to those seen in Europe.11 But a growing number of scientists, policymakers, and even “green” NGOs that had originally opposed GMOs, now recognize the counterproductive results of this approach and are working to avoid repeating the same mistakes with gene editing. This shines a spotlight on the most important and potentially fruitful opportunity for transatlantic cooperation in biotechnology: the revival of science-based regulatory regimes in which the degree of regulatory oversight is proportional to the hazards involved, and regulation that enables, rather than discourages the safe development of innovative products. A return to and reaffirmation of these first principles would provide fertile ground for cooperation and coordination globally. Regulatory reform (everywhere, not just in the EU and its emulators, though the need is greatest there) provides fertile ground for transatlantic cooperation and coordination. We have robust models of proven approaches.12 Without such cooperation, other progress in developing and deploying innovative solutions through biotechnology will be impeded or foregone. As to national security risks, just as with other risks, novelty attributable to biotechnology is elusive. One can do very nasty things with conventional bioweapons, and they are easily magnified with recombinant DNA techniques. At the same time, defensive capacities are also buttressed by biotechnology, as demonstrated by the rapid development of mRNA vaccines against SARS-CoV-2. There has been some good work done in this area, but this topic is worth exploring at greater depth. The OECD has a track record of thoughtful analyses with such topics. One possibility would be to build on that foundation by establishing a joint OECD/NATO working group to serve as a forum.

### Allies say yes

#### Empirically NATO say’s yes to plans on emerging tech

Robert K. Ackerman, 19. 10-1-2019, "Innovation Leads NATO Modernization Efforts," SIGNAL Magazine, https://www.afcea.org/content/innovation-leads-nato-modernization-efforts//AL

NATO is accelerating its efforts to input innovation into its operational capabilities. This effort is aided both by industry and academia and by different nations that bring new technology applications to the alliance table. But even the best ideas are encountering speed bumps, and adversaries are moving quickly to exploit their own technological advances. Through its Allied Command Transformation (ACT), headquartered in Norfolk, Virginia, NATO has focused capability development on emerging technologies that can change battlespace operations. An innovation center developed with local academia is earmarked to grow into a full-fledged laboratory that would seed new capabilities into the force. And the ACT is improving NATO’s state-of-the-art battlefield network to accommodate advances in command and control (C2). One advantage NATO has for innovation is strength in numbers. The alliance’s 29 members all have innovation assets that can be brought to bear in planning future military systems. Yet that broad membership also offers a significant drawback. The alliance must agree on systems that meet advanced capabilities and are interoperable among NATO’s members. Lt. Gen. Thomas J. Sharpy, USAF, deputy chief of staff for capability development at the ACT, offers that the command is looking to the future to maintain a military edge across all the capabilities it delivers. This involves making sure it is applying innovation to either adapt current capabilities or revamp them, building on progress from science and technology advances in industry, academia and other nations. “Hockey great Wayne Gretzky once said, ‘Good hockey players skate to where the puck is; great hockey players skate to where the puck is going to be,’” the general relates. “We are trying to figure out where the puck is going to be and develop those capabilities so that we maintain that military edge as our competitors are trying to do the exact same thing,” he declares. The ACT has stood up an innovation branch within the capability development directorate to go with an innovation hub partnered with Old Dominion University. Gen. Sharpy notes that the directorate is moving ahead with plans to escalate this hub into a laboratory that would enable incremental as well as open innovation through academia. With the growth of this center, the ACT would align resources to extend innovation across all aspects of the ACT. He describes this innovation center as “very effective at integrating with academia and like-minded personnel amongst the alliance.” It also is working with people who are not part of NATO to capture innovation as it emerges. He looks to improve this effort by providing the center with more resources and more people. This would enable it to be a laboratory where ideas could be cultivated with industry for demonstrations by the military. Another advantage would be that the facility is located in the United States, so U.S. participants would not have to travel to and across Europe to deal with NATO. The ACT has developed an emerging disruptive technology road map that focuses on command and control, big data, artificial intelligence (AI), automation, hypersonics and other areas that many nations also are exploring. This effort is part of the command’s overall thrust. “We’re not only trying to put coherence into those systems that we have, but also are trying to look at using innovation to make them maintain cutting edge so we maintain our military edge going forward,” Gen. Sharpy says. “We don’t want to be lagging in those, because those are the big rocks that we are trying to move. “Even though we might not be in a conflict, I would say that cyber is a contested domain every single day,” the general continues. “Being able to leverage the same opportunities that cyber provides us from a good standpoint also enables our adversaries in the negative standpoint, because they have the same capabilities.”

#### Growing threat of russia and emerging tech means NATO says yes

Chris Dolan 22, 6-8-2022, "NATO’s 2022 Strategic Concept Must Enhance Digital Access and Capacities,"[ Dolan is a Professor of Political Science and Director of the Master’s of Science Intelligence and Security at Lebanon Valley College. He is currently a Fulbright U.S. Scholar (2021-2022) in security studies at the Max Van der Stoel Institute at South East European University in Tetovo, North Macedonia} Just Security, https://www.justsecurity.org/81839/natos-2022-strategic-concept-must-enhance-digital-access-and-capacities//AL

The Strategic Concept is among NATO’s most important documents as it informs alliance planning, resource allocation, and programming based on changes in the threat environment. But the document has not been updated since 2010. The 2010 Strategic Concept, entitled “Active engagement, Modern Defense,” contained just one brief sentence about cyber attacks and did not even mention China. It also stated that “Today, the Euro-Atlantic area is at peace,” even though Russia had invaded Georgia two years before and the threat of a return to great power competition loomed. To argue that a lot has happened between 2010 and 2022 would be an understatement. Russia’s annexation of Crimea and intervention in the Donbas in 2014 and the invasion of Ukraine in 2022 shattered any illusions of a lasting peace with Russia. China’s territorial ambitions, economic assertiveness, threats against Taiwan, and military modernization threaten the rules-based order. Emerging technologies – in the form of hypersonic weapons, artificial intelligence, quantum computing, and machine learning – have intensified great power competition. The 2022 Strategic Concept should highlight the essential role of technology in collective defense. To build greater digital capacity while also emphasizing resilience, NATO must adopt a new technological orientation on the military strategic level of command, especially within the Allied Command Transformation (ACT) in Norfolk, Virginia and the Allied Command Operations (ACO) in Mons, Belgium. ACT leverages advanced technologies for security and defense in capabilities, procedures, public-private partnerships, civil-military relations, and at NATO’s Centers of Excellence. Led by the Supreme Allied Commander Europe, ACO is responsible for collective defense through direction, requirements, planning, and execution at the strategic level. However, the Strategic Concept 2022 should focus less on the emergence of new technologies and more on how NATO’s military and civilian personnel use them. ACO and ACT must emphasize greater accessibility to information and data for its multinational warfighters, cyber operators, and civilian professionals. NATO must reach out to experts in the private sector, academia, and non-governmental organizations to harness ways to expand access and emphasize flexibility in multi-domain operations. NATO can do this by providing more grants to private sector partners and establish a new center of excellence on data and information sharing. ACO and ACT should also enable personnel and partners to readily access data and information in DIMEL domains: diplomatic, information/cyber, military, economic, and legal. This would expand the range of measures needed by ACT and ACO to connect and correlate deterrence with evolving hybrid threats. To deter hybrid threats across multiple domains, with enhanced access on different digital platforms, NATO members should develop smarter and lethal capabilities to confront threats from state and non-state actors. This would allow ACT and ACO to prepare for any contingency and respond to adversaries in battlefields and battlespaces. Plug and Play The 2022 Strategic Concept encourages collaboration in the implementation of guidelines and procedures through a “plug-and-play” concept, in which platforms and systems are optimized for readiness and response at lightning speed. Plug-and-play is based on approaches used in commercial software that allow for innovation and easy access to networks and systems through secure platforms. The NATO School Oberammergau should offer platform training and education courses programs in mobile access for ACT and ACO personnel with appropriate security clearances. This would allow them to access the appropriate platform and utilize data and information necessary for their tasks and responsibilities. For example, NATO’s Small Arms and Light Weapons (SALW) and Mine Action (MA) Information Sharing Platform contains rich and publicly available datasets on the roles played by the alliance in mitigating the illicit trade in small arms, tanks, aircraft, and naval vessels. It reports and updates NATO-funded projects to prevent adversaries from acquiring these weapons. However, the SALW-MA platform is outdated and not user friendly, impeding its functionality in practice. Put simply, NATO’s ACT and ACO should focus as much on easing access to information as it does on advanced technologies and conventional weaponry. This would provide NATO with useful tools to access data and intelligence on the strategic, operational, and tactical levels and in land, sea, air, space, and cyber domains using devices and platforms that can seamlessly connect in different locations. But NATO Commands cannot simply expect its existing personnel to adapt. They must be trained and educated on a regular basis to use digital infrastructures in ways that make their jobs easier. On the strategic level, the 2022 Strategic Concept must provide NATO’s political and military leaders with flexibility and resources to discern the diversity of hybrid threats in the environment. NATO’s strategic planners, cyber operators, and warfighters should be trained and educated in relevant digital platforms, access, and sharing data and information in ways that improve collaborative decision-making and collective defense. On the operations level, personnel must be given enough space to share data and intelligence as well as to train tactical level personnel on software that enables them to collect, analyze, process, and disseminate information quickly and easily across multiple domains. Addressing these challenges is difficult for just one nation-state, let alone for all 30 NATO members. Therefore, the 2022 Strategic Concept should emphasize connectivity between member states in multi-domain operations and in collaboration with the private sector and academia. Accessibility to information and data sharing among NATO members should be securitized and harmonized.